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Cover: How will our homes function in the near future? We've highlighted key areas and plotted out a complete solution. (Image: Fibaro)
This page: Take a stand to kick-start your career and get out of your chair – literally. For constructional details, see our Skills section from page 87.





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LOOKING BACK, LOOKING FORWARD, LOOKING UP

History happens all the time. But back in September, when we were assembling this issue of POPULAR MECHANICS, some particularly momentous things happened. (Let's gloss over one of the more momentous, if you don't mind: that historic defeat of South Africa by Japan at the Rugby World Cup.)

Down here on the ground, the unearthing on local soil of what is being called an entirely new member of the genus *Homo* rattled skeletons around the world. Even better, the story of *Homo Naledi* progresses like one of those blockbuster Ken Follet history sagas: ancient burial rites, claustrophobic caves and a mysterious quest for archeologists with one defining characteristic – the ability to squeeze into XXXS clothing.

Above us, the activity was even more frenetic.

The discovery of what seemed to be water seemed to confirm what some had been saying all along, namely that life of a kind could exist on our planetary neighbour Mars. Incidentally, if it looks like there's a lot of "seemed" going on there, that's because history has a way of rewriting itself. And because many of us do like to see things proven beyond a reasonable doubt.

But the heavenly revelations weren't done yet. Although I don't have personal experience of this, as the combination of a Blood Moon and a Supermoon wasn't enough to rouse me in the early hours of the morning, when it was visible. I'm told that, if my genes hold good, when the Supermoon comes around once again in 30 years' time I will have a second opportunity to sleep through it.

In the meantime, isn't it great that, we are turning our gaze to the skies once more? For Ridley Scott it certainly is, because whether by dint of exquisite timing or simply good luck, the his new movie *The Martian* happened to coincide with all this astronomical astonishment.

Like my predecessor as PM Editor, Alan Duggan, I saw and was captivated by Scott's epochal *Blade Runner* on its debut. Duggan's nod to the genre was the establishment of the Electric Sheep* award to PM's best in-house monthly achiever. It's intriguing that, for one who has become somewhat identified with sci-fi, Scott is with *The Martian* finally embracing the "sci" part as main character instead of just backdrop, as you will read inside this issue.

**Matt Damon on Martian
(actually Jordanian) soil.**



Last time I looked, our civilisation hadn't yet evolved – or should that be descended? – to the dystopian existence reflected in *Blade Runner*. Although that may not be entirely a bad thing, a hover taxi would be seriously cool. As indeed it might be in a future Johannesburg, which as we describe on Page 54, is grappling with the idea of ecomobility.

That's about tomorrow, though. Today, we have to deal with matters much more prosaic than hover taxis. Such as, what happens when we flush. You'll be pleased, then, that a new-generation loo is but one of the tools of tomorrow we cover in our feature *The Future of the Modern Home*, which starts on page 30.

Finally, after roughly a year, the POPULAR MECHANICS team is finally back up to full strength with the addition of Kyle Kock. Our latest recruit polished his automotive chops at the country's leading motoring magazine, *CAR*, but there's a lot more to him than that, as you will discover in the coming months. And he's not as serious as he looks.



Anthony

* *Blade Runner* was based on Philip K Dick's *Do Androids Dream of Electric Sheep?*

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THE SKIMMING SCHEME

Your article about replacing worn brake pads (Skills, July 2015), doesn't address a potentially lethal scenario.

Brake disc rotors also wear and, because of the high cost of replacing these, to save money people opt to have them machined – “skimmed”. Fitting new pads that have a completely flat friction surface to an unevenly worn rotor is just plain dumb. But skimming discs can cost you your life; it should be considered and done only by an experienced brake repair specialist, if at all.

Rotors usually wear in a concave pattern. Skimming the rotor to render it parallel and match the flat friction face of new brake pads could reduce overall thickness of the rotor dangerously below specification.

The garage foreman may try his best to persuade you to have the rotors skimmed in situ. For the garage it's a quick in-and-out job and they make a handsome profit. But my experience with workshop “machinists” is not encouraging.

With subsequent wear of skimmed disc and new pads in use, the hydraulic piston on the calliper may be pushed

beyond its designed, inbuilt safety parameters, out of its housing, far enough to “twist” and allow the brake fluid contained behind it to leak out in a sudden gush under braking pressure. The invariable result is instant, total brake failure. All because you wanted to save a few hundred rand...

In the 40-odd years that I ran my own workshop, I have witnessed the scary consequences of this scenario a number of times. The only times I ever consented to have discs skimmed was to machine out minor warps to eliminate brake judder under heavy braking and then only under my personal supervision using the skills of a qualified turner/machinist to ensure that after machining, the rotor was still within the design specifications of the manufacturer.

I have been told that in some European countries, skimming discs is a criminal offence.

LEON DU TOIT
BY EMAIL
(Shortened – Editor)

Send your letter to: **POPULAR MECHANICS**, PO Box 180, Howard Place 7450, or e-mail popularmechanics@ramsaymedia.co.za Please keep it short and to the point. Regrettably, prizes can be awarded only to South African residents.

BIRTH OF A LEGEND?

Your article on the Ford Shelby V8 for the GT 350 Mustang (Cars, August 2015) implies that single/flat plane crankshafts are a new thing in V8 engines. In fact, they were used earlier than the 1920s in roadgoing V8s. In the late 1960s and early 1970s a couple of high-performance V8 manufacturers used single plane crankshafts, albeit with counterbalance shafts to reduce the additional vibrations inherent to this flat design.

BMW's M3 of about 2007 was a 4,0-litre V8 with some specs surprisingly similar to those of the new GT Mustang: static compression ratio 12:1, rev limit 8 400 r/min and bore 92 mm. Its stroke was, however, only 75 mm, with a resulting piston speed of 4 150 ft/min, which is acceptable for a road machine (piston speed in feet per minute = $[\text{stroke} \times \text{r/min}] / 153$).

This is where the new Mustang GT may have overstepped the mark. It has

a stroke of 93 mm, combined with an 8 250 r/min limit, giving a piston speed of 5 015 ft/min. As piston speed increases, the engine will fatigue and wear exponentially quicker.

Even for engines using the best possible materials for their rotating and reciprocating parts such as crankshafts, pistons, and connecting rods and rod bolts, piston speeds are kept within acceptable limits. A 1980s Formula One six-cylinder engine had an average stroke of 40 mm and a rev limit of 12 500. Piston speed: 3 300 ft/min.

If we consider one of the world's most powerful normally aspirated engines in terms of output per engine capacity, the early Honda S2000 had a stroke of 84,4 mm, limit of 8 900 r/min and a piston speed of 4 900 ft/min. Their revised later version had a stroke of 90,7 mm, rev limit of 8 000 and a resulting piston speed of 4 750 ft/min. Isn't it interesting that Honda lowered the piston speed



Ford Shelby V8

and rev limit with that long 90,7 mm stroke crank!

An interesting way to observe the simple piston speed equation is that, if you are to halve the stroke, it allows you

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THE ART OF PERFORMANCE





to double the safe rev limit. Consider the motorcycle engine. Its stroke is generally half that of an average car engine's, yet its rev limit is generally double.

If the new GT Mustang enjoys longevity despite this exceptionally high piston speed (normally acceptable only in drag racing engines that get rebuilt almost every quarter-mile run), it certainly will be a legend – and a grand handshake to Jamal Hameedi and Ford SVT.

ANGUS MOODIE
REDLINE ENGINEERING
CAPE TOWN

AI IS THE REAL DANGER

Damien Coulson (AI: Our little helper, Letters October) proposes that we ignore the doom and gloom propaganda around Artificial Intelligence. According to many highly regarded scientists and technologists – think Stephen Hawking and Elon Musk – technological singularity is the most likely existential threat facing human beings. Such a singularity refers to the moment when a computer starts to recursively self-improve. This is not too far away, most likely within the next 100 years. When this happens, we will not be faced by humanoid robots on par with human beings, as in most sci-fi movies, but entities so vastly more intelligent than ourselves that we can hardly comprehend it.

Right now we need to work on a way to ensure safe AI in the near future. This is a problem that is more dangerous than global warming, world health problems or asteroid collisions, but receives far less exposure.

MARTIN TERBLANCHE
BRAMLEY, JOHANNESBURG

KEEPING US UP TO SPEED

I want to start by first saying thank you to POPULAR MECHANICS for all the amazing articles that you have published over the years. Supertrains (May 2015), The biggest ship in the world (March 2015)

and 3D printing (June 2015) keep the older folk like me up to speed with everything happening in the world around them. The articles about robotics are especially interesting, seeing as

TOOLS OF THE TRADE

My grandfather did his apprenticeship as a wagon wheel maker back in late 1890s. I recall him proudly telling us that, during his first year as an apprentice, he did not use a tool at all. He spent the first year learning to maintain and look after tools. The accompanying picture shows some of his planes.

Interestingly, while he was doing his apprenticeship, the railway between Durban and Johannesburg was being built and the wagon wheel business died. So job redundancy is not new! He went on to become a cabinet maker.

One other noteworthy aspect of his life was that, when he died in 1967, it was finally possible to fly by jet plane from Johannesburg to London. We think we live in exciting times!

FRANCIS SEARLE, BY EMAIL



robots are the future and knowledge about them and their technology is unbelievably helpful. As soon as the magazine arrives on my doorstep my father and I argue about who gets to read first, although we both start at the last page where all the helpful tips are. I have used these tips often and they all are very useful in their own way.

Among the most helpful things, personally, that I have read were two in July 2015 – one about skills in the workshop and another about restoring old tools. I dare say many of the tools in my workshop would have been thrown out had it not been for the restoration article.

My only word of advice to you is that, if possible, add some more projects for parents and kids to do together, such as the walking stick robot. Keep up the good work.

DRIKUS STEYN
LYDENBURG

WATER WARS

In response to Douw Kruger's "Down the drain" (Letters, August), I have my own experience with stormwater drains to relate. Years ago I ran a swimming pool installation and rebuild company in the Western Cape. The local authorities were constantly snooping on me. One of their cronies informed me that the waste water from the filter backwash was not allowed to return to the sewer, but had to be led to the stormwater drainage. In

my first discussion with him he did not see my point that, as the water in the swimming pool had been bought from the Council, they were responsible for taking it back – like water used in the toilet, bath and washing machine. I was duly reported to the town engineer. During my meeting with the engineer I stood by my point and won my case. And the interference stopped.

DEON OBERHOLTSTER
BY EMAIL

LEDS SPOIL THE TUNE

I have begun to replace the 50+ halogen 50 W downlighters in my house with 4 W LEDs. These provide adequate light with the promise of vastly reduced energy consumption.

A side effect that I didn't envisage was the radio interference these lights make on my hi-fi tuner. It's impossible to listen to my favourite FM stations when these lights are on. AM waveband is unaffected. I've tried replacing the antenna cable with coaxial TV cable, but it's made no difference. An Internet search for a solution revealed that the problem is commonplace and no viable solutions seem to be available. If there isn't a solution then please warn others through your pages that going the green route has some unwelcome side effects.

ROBIN HAYES
BY EMAIL PM



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October 1956

Six decades before our current focus on the future of the modern home (Page 30), home design reflected the notion of suburbia and the nuclear family. In PM's annual Home section, a revolutionary new building concept featured a structure distinct from, and built around, self-contained modular "core" units, each focused on a function such as power, entertainment, food or communications. Described as having "a slight Japanese flavour" (it allowed areas to be opened and closed as needed), this modular scheme responded to trends such as convenience foods supplanting conventional cooking.



1974

Ecomobility is about integrated ways of getting around, as this month's feature (Page 54) explains – walking, cycling, public and planet-friendly transport. Unlike the first three, fortunately "green" transport has advanced since the 1970s, when the CitiCar arrived on the scene. The car's six 6-volt batteries powered a 1,8 kW DC motor, which drove the rear wheels via a transaxle and was capable of hauling the two-seater along for 80 kilometres at up to 45 km/h. Oh, and you're quite right, it evolved from a golf cart.

Our test of what's been described as today's smallest GPS-capable cycling computer (Page 26) shows how far we have progressed in activity and lifestyle monitoring. The Swiss-made timepiece featured here indicated the wearer's expected high and low points, based on biorhythms (remember those?). Sadly, this did not include lifestyle advice, which explains why its existence coincided with bell bottoms, mutton chop sideburns and droopy moustaches.

PM



1938

Also on test this month (Page 26), the latest in action cams is, it seems, merely a modern equivalent to an impeccably attired New York aviator's remote-controlled camera. Pulling a string activated the shutter of a folding camera in a cigar box attached to the left wing of the aircraft, thereby demonstrating an early example of the selfie.



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HOW YOUR WORLD WORKS

BRAIN RESEARCH ► COLDEST WAR ► CURING EMAIL ► FOOD AGEING ► GREAT UNKNOWNNS ► RUBBER TECH

Scientists at the University of Virginia have discovered lymph vessels in the brains of mice (they have done pilot studies in human brains) that could change the direction of research on brain diseases. This is how researchers believe the system could look in humans.

CONGRATULATIONS ON YOUR NEW BODY PART!

Immune vessels recently discovered in the brains of mice may also exist in human brains. Either way, research on brain diseases is about to change.

BY JACQUELINE
DETWILER

ILLUSTRATION BY BRYAN CHRISTIE DESIGN

FOUR MILLENNIA INTO THE STUDY OF ANATOMY, new body parts are discovered at about the rate that comets buzz the Earth, often with a similar amount of fanfare. The last one, in 2013, was a knee ligament. Before that, it was a microscopically thin layer of eyeball. This year Antoine Louveau, Jonathan Kipnis and their colleagues at the University of Virginia School of Medicine discovered a possible piece of anatomy worth a great deal more excitement: a section of the immune system that reaches into the brain.

The discovery was a viral news story for two days: "Lymphatic Vessels Extend Into Brain!" To many, it was another comet, but to scientists who study an unmapped, last-frontier kind of system like the brain, a discovery like this upends fundamental theories, the same way finding iron-based cells or water on Mars would. Over the past decade researchers had increasingly seen evidence that the brain and the immune systems interact, but no one was sure how. "We were always trying to interpret how the two systems communicated based on the fact that this structure didn't exist," says Louveau. Now that we know it does, researchers who work on every brain disease with a suspected immune component have the opportunity to try something completely new. Here are four scientists who are excited about what that means.



Antoine Louveau (top) is a post-doctoral fellow in the lab of Jonathan Kipnis at the University of Virginia. Louveau found the vessels while trying to confirm that they didn't exist.

FOR MULTIPLE SCLEROSIS

In patients who have multiple sclerosis, an overactive immune response causes T cells to attack myelin, a fatty neuron sheath that speeds impulses through the brain. Some MS drugs, such as natalizumab (brand name Tysabri), work by preventing T cells from passing into the brain through blood vessels, but this can allow nasty infections to spread unchecked. "Maybe there's an approach where we can target these new lymphatic vessels to accomplish the same feat without the side effects," says Bruce Bebo, executive vice president of research at the US National MS Society. "That's just one potential example."

FOR AUTISM

In some kids who have autism, getting a fever from the flu or a cold can temporarily improve behaviour, attention, even verbal skills. Researchers suspect this may be related to chemical messengers called cytokines, which can communicate to both neurons and immune cells. "For me, knowing that this system exists helps with trying to match what's going on in the body with what's going on in the brain," says Judy van de Water, an immunologist at the University of California Davis Mind Institute. Measuring cytokines in the lymphatic system of mice in real time could help researchers figure out how the fever effect works.

FOR ALZHEIMER'S DISEASE

"One of the big surprises in the genome studies that have come out over the past five or six years was that there is a whole set of genes that affect Alzheimer's that are expressed in the immune system, not in neurons," says Bruce T Lamb, staff scientist at the department of neurosciences at the Cleveland Clinic. Scientists believe most of the deficits seen in Alzheimer's patients are related to a misfolded protein called amyloid-beta that isn't cleared properly from the brain. The next step is to determine whether a malfunction in these newly discovered vessels could be responsible.

FOR DEPRESSION

Some of the most exciting research on depression concerns the role of the gut microbiome – the contingent of bacterial cells that live in the stomach and intestines. Depressed patients are more likely to have certain bacterial species in their excrement, and feeding mice particular probiotics can reduce behaviours that mimic depression. "There was some beautiful work just published that showed that changes in the gut microbiome can change the structure and function of microglia, which are immune cells in the brain. How can bacteria affect those?" says Kipnis. "We don't know, but we're working with the author of that study to find out."

OTHER BRILLIANT COMBINATIONS IN SCIENCE

Interactions between the immune system and the brain have been intensively studied since only 2008 or 2009, when scientific consensus that the two systems were connected reached critical mass, popularising the field of neuroimmunology. Here, three other cross-disciplinary sciences that might change the world.

– JAKE CAPPUCCINO



Physics + Biology =

QUANTUM BIOLOGY

Deeper than molecular biology, quantum biology uses computers to model the profoundly weird quantum-mechanical processes behind biological phenomena such as photosynthesis.



Psychology + Genetics =

EPIGENETICS

Once geneticists had mapped the human genome, they could study how the environment changes the way genes are expressed in real life. One crazy finding: some changes to genes after birth can be passed on to the next generation.



Chemistry + Materials Science =

CHEMOMECHANICS

Scientists in this field study how mechanical forces at an atomic level affect the shape and function of materials, helping to create smarter components for the fields of medicine and construction.

THE COLDEST WAR

Unclaimed and rapidly becoming more valuable, the Arctic Circle has become the centre of the latest international arms race.

BY JOE PAPPALARDO

SOME 20 PER CENT OF THE ICE in the Arctic is expected to melt by 2050, opening about 2.5 million square kilometres of valuable terrain to shipping, oil drilling, mining and tourism – all of it located in one of the few places on the planet without an owner. “There are many competing claims, and whoever can enforce the claims will reap the benefits of the resources,” says Sim Tack, a military analyst with the global intelligence and advisory firm Stratfor. The high north is also valuable from a military standpoint, and with no treaties prohibiting the deployment of weapons there, nations around the Arctic Circle – including the United States, Norway, Canada, Sweden and Russia – are sending up equipment and vehicles to develop a presence. “Demonstrating the ability to deploy forces into the Arctic backs territorial claims and boosts the perception of a military deterrent,” says Tack. Here’s who’s building what above latitude 66° 32’ N.

1 Satellites

Military satellites in geostationary orbits around the equator can’t make contact with Arctic ground terminals because signals are blocked by the curvature of the Earth, much the same way a fly buzzing around an apple’s centre can’t see the stem. Now the US Navy is launching a network of satellites, the Mobile User Objective System (MUOS), that has more high-power beams and waveforms that can bend around the Earth’s curves to reach the poles.

 **UNITED STATES**

2 Aerial drones

Low temperatures can cause moisture to freeze on the wings of unmanned aerial vehicles, weighing them down and jamming flight-control surfaces. As a result, both Canada and Russia are testing models that can tolerate minus 34° C temperatures and high winds. Last year Canada tested a drone helicopter during August exercises in the Arctic. The Russians, meanwhile, began field-testing the propeller-driven Orlan-10 this year.

 **CANADA**,  **RUSSIA**

3 A new spy ship

Since the mid-1990s Norway’s naval vessel *Marjata* has been conducting surveillance on Russia’s Northern Fleet. Now the Norwegian Intelligence Service is buying a new ship, for about R3.4 billion. When operational in 2016, the next *Marjata* (it’s keeping the name) will be almost twice as large – at 126 metres long, the size of a large passenger ferry – and ready to cover more ground for longer periods, enabling the Norwegians to watch their Arctic backyard.

 **NORWAY**

4 Submersible robots

In May, the Nato research vessel *Alliance* cruised off the coast of Norway to test underwater robots that could be used to hunt submarines in the Arctic. Among the equipment tested were gliders powered by wave motion and torpedo-shaped bots that use on-board sonar to listen for signals. Researchers say future versions of the latter could drop strings of disposable sonar sensors, called sonobuoys, to create invisible nets.

 **NATO**

5 Nuclear-missile submarines

The Arctic is important in part because it’s the preferred place for US and Russian submarines to launch nuclear missiles in the event of a cataclysmic war. “The shortest distance between Nato countries and Russia is within the Arctic Circle,” says Tack. This is why the Pentagon is concerned about Russia moving new Borei-class submarines with water-jet propulsion and long-range sonar into the area over the past year.

 **RUSSIA**



HOW TO CURE EMAIL

Spending hours on correspondence makes employees inefficient. So a few companies have begun (temporarily) outlawing it. BY ALEXANDER GEORGE

LATE LAST SUMMER Mary Pat Knadler, a research fellow at pharmaceutical giant Eli Lilly and Company, received an email that made her concerned that she was going to annoy her colleagues. For ten days she and 179 other employees at her Indianapolis office would not be able to use Outlook between 8 am and 10 am “I work with people around the globe. That’s a time when I am very productive,” Knadler says. Even through multiple time zones, when she sends an email, she knows the person on the other end will see it as soon as he’s available. And vice versa.

THE ART OF BEING UNAVAILABLE

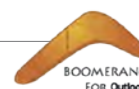
If your company won’t consider an email suspension, you can use apps to reclaim your productivity. Here are three that make the Internet saner.

FREEDOM

Specify a time frame, and this application will block your Internet connection, relenting only if you reboot your computer. It also prevents you from going down Wikipedia rabbit holes. (R140)

RescueTime

It runs in the background, tracking your computer use to help you adjust your habits. Tell it your most time-sucking sites and it’ll kick you off after you reach your self-imposed limit. (Free, or R1 000 per year).



Need to send an email after work but don’t want to stress anyone else out? Download this plug-in for Outlook or Gmail and you can schedule it. Start with a whole year’s worth of Happy Birthday messages. (Free trial)



Conversation starters for smart people

Date of the first email: 1971

Number of emails sent each day: **More than 205 billion**

Why do email addresses contain the @ symbol? “It’s the only preposition on the keyboard.” — Ray Tomlinson, email’s inventor

If you’ve worked in an office since roughly 1997, you can understand Knadler’s concern. In an age of constant push notifications, every chime feels urgent, to the point that it damages our ability to concentrate. Electronic mail sucks about two-and-a-half hours from a typical employee’s workday, and can diminish the restorative effect of time off. This is why companies such as IT firm Atos Origin have zero-email policies and why, when someone at Daimler, the German carmaker, is on vacation, the company server deletes incoming emails from the employee’s inbox. Eli Lilly, a company that made nearly R300 billion last year, decided to experiment with a temporary email hiatus, in the hope of easing the burden.

To do this, the company built a program that would intentionally disable Outlook every morning for 10 days. The results: Participants sent 90 per cent fewer emails during those two hours (a few used their phones to sneak around the ban) and 30 per cent fewer emails throughout each day. Using estimates for the average time an employee spends composing an email, and assuming that the time was used for something productive, Eli Lilly analysts estimated a productivity increase of 10 per cent. Those figures don’t include time spent reading emails, making the results a conservative estimate of the benefits that can come from restriction. “It’s liberating to know that most things can wait 24 hours,” says Anja Stauber, a director of toxicology who participated in – and enjoy – the trial. “Waiting can actually make [your response] better.”

Knadler’s email-free period didn’t go quite as smoothly. Some of the other Eli Lilly branches she worked with didn’t know of the trial. Though there were no flame-outs or missed multimillion-dollar deals, she did receive follow-ups from colleagues who asked why she wasn’t responding quickly. “I apologised a lot,” she says. Her experience, maybe, is the email problem in miniature – manufactured urgency creating the expectation that immediate responses are both possible and desirable.

Those who are disciplined enough to control email, rather than allowing it to control them, may prefer to leave the medium the way it is. Psychological research, however, indicates that allowing the inbox to continue its bullying will bring the rest of us to the end of the workday feeling as though we’d gotten nothing done. Temporary breaks like Eli Lilly’s portend a future in which employers respect human attention as the sole remaining technological limit to productivity – a future in which the only office communiqué likely to cause a panic attack is the fire alarm.

ALL THE GOOD FOODS ARE HALF BAD

Beef, cheese, wine – all flavourful and all aged. Here's why the tastiest old food doesn't make you sick. BY WYLIE DUFRESNE

THE FIRST TIME I TASTED ROT – as in real, funky, fully formed mould – I was not in any condition to legitimately evaluate it. I had put away one too many drinks and figured I should eat something, so I headed into a dark kitchen, grabbed a slice of bread from the bread box, and chased it down with a glass of milk. Two seconds later I realised something was horribly wrong. I turned on the lights and saw that the bread, like my judgment, was fuzzy.

There's a rather large difference between rotten bread and something that's deliciously and intentionally rotted. The terms that describe the latter include dry-aged, fermented, and ripened, but they all refer to the same thing: creating the unique conditions under which desirable microbes can flourish, transforming a food into something delicious while undesirable microbes die off.

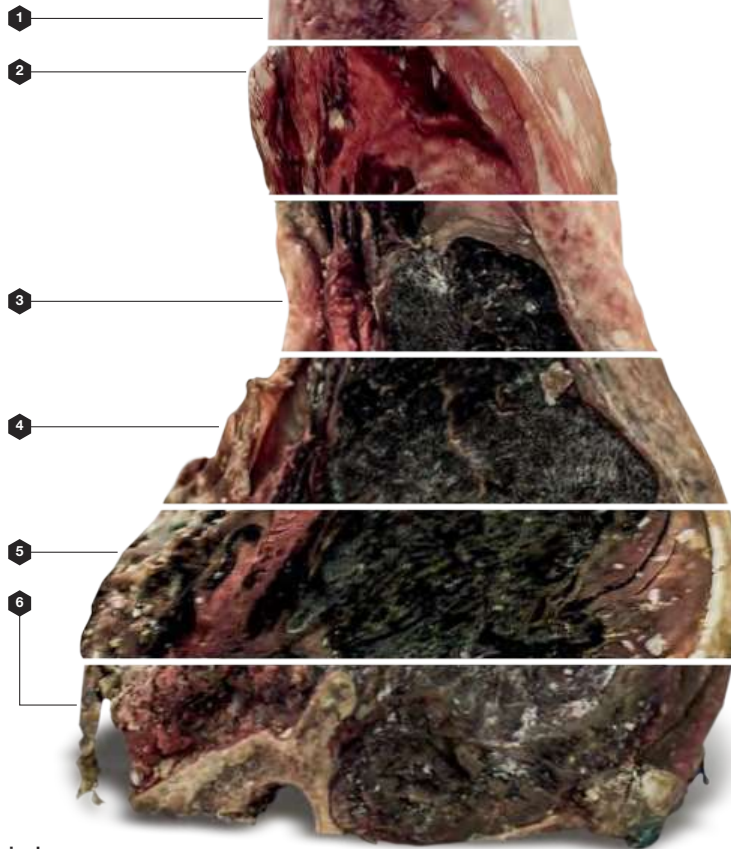
Most kinds of "good rot" are rooted in the practices of preserving food. Take, for example, sauerkraut. At some point somebody figured out that salting a bunch of chopped-up cabbage and leaving it in a barrel creates a mash that tastes great and lasts longer than an old head of cabbage left in the root cellar. He probably didn't know anything about the lactic acid-producing bacteria that lower the pH of the mash, making it safe to eat.

Lactic acid bacteria live on cabbage leaves in the field, but in many cases creating good rot involves introducing a protective mould or bacterial culture to a food and keeping it happy enough to grow. Blue cheeses get stabbed with skewers covered in strains of penicillium mould to create those signature veins and give the cheese its distinctive taste. Camembert's white rind is another type of penicillium that gives the cheese its slightly funky flavour and defends the cheese from dangerous microbes like a shield.

Though I eat cheese almost every day, I think the fine art of rotting is at its best when applied to dry-aged beef. Butchers store whole racks of rib steaks in a very cold and slightly humid environment, allowing time for enzymes already inside the meat to slowly start breaking it down, bringing out the potential sweetness and umami (savory taste) hidden within the protein and glycogen. The fat cap – the layer of fat over the meat – reacts with oxygen from the air at a steady pace. While the flesh is transformed, so is the fat that bastes it as it cooks.

Some argue over whether dry-aged beef is texturally

THE JOURNEY OF A STRIP LOIN AT PAT LAFRIEDA MEAT PURVEYORS.



1. Original.

2. Aged 21 days.

Collagen begins breaking down.

3. Aged 30 days.

About 15 per cent of water weight lost.

4. Aged 40 days.

Funkier tasting.

5. Aged 50 days.

The white is good mould and salt, similar to that on an aged cheese.

6. Aged 120 days.

The true connoisseur's steak.

better (I believe it is), but everyone agrees that the flavour is superior and significantly more complex than that of un-aged beef. Both the flavour and texture are due to the action of microscopic entities similar to the ones that would ruin a neglected ribeye. The difference comes down to the species of microbe you're allowing to grow: an old piece of meat left in your fridge could pick up dangerous microbes from the foods around it the same way butter left open absorbs other flavours. It would end up covered in mould, of course. Just not the kind you'd want to eat.



WYLIE DUFRESNE IS A MAD SCIENTIST AND CHEF AT ALDER IN NEW YORK CITY.

MYSTERIES OF OLD FOOD REVEALED



What are the ideal conditions for ageing a steak? Dry ageing doesn't actually mean the steak sits around in a sauna. It just means that it loses moisture during the process. Most steaks are dry-aged for 14 to 35 days at 0 to 4 degrees Celsius and a

humidity of 80 to 85 per cent. During that time, collagen, a tough connective protein, breaks down, making the steak more tender.

Why do we eat aged beef, but not pork or chicken? Part of the reason might just be lack of demand. Ageing

usually adds an upcharge, and expensive chicken lacks the intrigue of an expensive porterhouse. On the other hand, pork contains less collagen than beef, so the perceived change in tenderness from ageing might also be less noticeable. – LARA SOROKANICH

A woman with blonde hair, wearing a black dress with a colorful floral pattern, is holding a silver 2-in-1 laptop/tablet device above her head with both hands. The device is open, and its screen and keyboard form a triangular shape, resembling a roof. She is looking directly at the camera with a slight smile. The background is a blurred cityscape under a clear sky.

#INSIDEOUT

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GREAT UNKNOWN



**BIG QUESTIONS.
ANSWERS YOU CAN'T
FIND ON THE INTERNET.**



How do manufacturers keep packing more gigabytes of space onto smaller and smaller SD cards?

A **THE UNCEASING MARCH** towards more digital storage in smaller physical space traces its roots to the inception of the microchip. In 1965, an engineer named Gordon Moore, a future founder of chip-maker Intel, published a paper noting that the number of components that could be shoehorned onto a chip had doubled every year since 1959. He predicted the trend would continue – and indeed it has, for 50 years. Now, here we are, courtesy of what became known as Moore's law, with what amount to really small but very capable containers. SanDisk's new micro SD card, for instance, is about half the size of your thumbnail and can hold 200 gigabytes of data.

How the heck does it do that? It uses something called flash memory, which employs no moving parts. Flash, or solid-state, memory relies upon electrical charges centred over transistors to record the ones and zeros (bits) into which data is translated. Things get a tad complex, but in short the trick to upping the memory is to figure out how to use fewer electrons to make each bit a one or a zero. At the advent of flash memory it took millions of electrons per bit. Today each may require as few as 10 or 12. The next frontier is three-dimensional storage – stacking information vertically on a chip like a tiny skyscraper. A tiny skyscraper, we would

suggest, of the sort that might be populated by tiny men who jump off tiny balconies on to your data, packing it ever more tightly on the chip. Patent pending.



What is the loudest natural sound on Earth?

The loudest thing we've ever heard was a Kiss concert at Madison Square Garden – rivalled only, perhaps, by the bullhorn-grade shouting required to communicate with us over the ensuing 48 hours of temporary deafness. But there's nothing especially "natural" about pounding out "Love Gun" at sound-pressure levels that would drop a rhino at 400 metres, and Madison Square Garden is kind of its own planet anyway.

The key distinction here is whether you mean what is the loudest natural sound, or what is the loudest sound you could actually hear and live to talk about. A Google search might tell you that the loudest sound ever was the eruption of the Indonesian volcano Krakatoa in 1883. And in some sense, that's true. The explosion that kicked things off was measured at 172 decibels (dB) 160 kilometres away. To put that in perspective, a chainsaw is about 110 dB, and the pressure on your

ears doubles with each 6 dB increase. So figure, at the site, the sound was, let's see here, 172 minus 110 divided by 6... instantly-burst-all-your-blood-vessels-and-kill-you-before-you-even-hear-it loud. At that level (or anything above 194 dB) it doesn't even really count as a sound anymore – it's just a pressure wave.

Assuming you're talking about a natural sound that's audible rather than lethal, we turned up a few nominations. Richard Raspet, a physics professor at the University of Mississippi who specialises in outdoor sound propagation, suggests that the crack of a lightning bolt (not thunder) may be Mother Nature's noisiest noise. Michael Epstein, director of the Auditory Modelling and Processing Laboratory at Northeastern University, adds that the call of the blue whale can approach 190 dB. So do your ears a favour – skip the Kiss show, and, whatever you do, avoid scuba diving during thunderstorms, appealing as that may otherwise be.



Who was the Phillips that gave us the Phillips-head screwdriver?

You're talking about one Henry F Phillips, an inventor and engineer from Portland, Oregon, who patented the Phillips screwdriver and the Phillips-head screw in 1936. Before ole Hank worked his hardware magic, handymen were confined to the slot-head screw, and before that, screws with bolts for heads, which date to antiquity.

There's nothing wrong with slot-head screws per se. The issue arose as manufacturing became mechanised in the early 20th century. Turns out that whereas the average sober person can easily align a screwdriver in a slot-head screw, machines have a hard time handling it. Enter the first attempt at a fix: a screw with a square recess in the head. The brainchild of Canadian inventor PL Robertson, the Robertson screw was stifled by a licensing disagreement and never went into widespread production. Next was JP Thompson, who in 1933 patented a recessed cruciform screw intended to be self-centring. Thompson couldn't persuade industry of the benefits of his design, so he sold it to Phillips, who refined it, obtained fresh patents, and saw his namesake screw adopted, notably, by General Motors, who used it to build Cadillacs starting in 1937. It was, of course, a very smooth ride from there.

TREAD SECRETS

How a tyre maker goes from roots to rubber – and gets to grips with sports shoes

DANDELIONS SEEM AN UNLIKELY SOLUTION to the quest for sustainable tyres. But the ubiquitous wild flower – or, more precisely, its root – is what Continental is successfully employing as the basis for natural rubber. After manufacturing a prototype last year, the German company achieved a breakthrough by putting into production a tyre tread made of nothing but natural rubber from dandelion roots. The WinterContact TS 850 P is made using what Continental calls Taraxagum, derived from the botanical name for dandelion (taraxacum). It's an important step closer, Continental says, to reaching its long-term goal of making tyre production more sustainable and less dependent on traditional raw materials.

But the company's interest in tread matters doesn't stop at tyres. Adidas shoes feature rubber compounds specially developed for them by Continental. They are said to feature particularly high levels of grip on all surfaces, helping runners to conserve energy that would go to waste in a shoe with less grip. Technology transfer from tyres to shoes can result in performance improvements of up to 30 per cent, it's claimed. It could be coincidence, but the tyre/shoe partnership has racked up three men's marathon world records and multiple course records...

PM

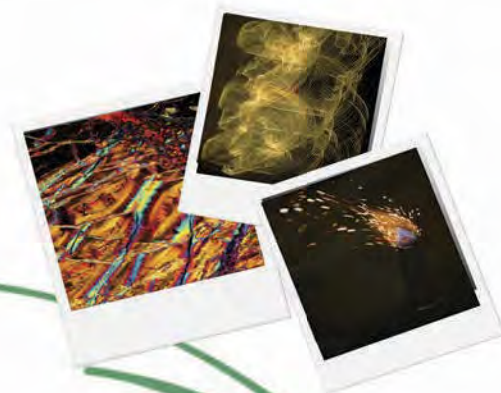


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GREAT STUFF



Asus ROG GX700

Hot lava ▲

Asus pulled out all the stops for undoubtedly the most intriguing device shown at IFA 2015 in Berlin this year, but were schtum when probed for details. There are rumours of a 17-inch 4K IPS screen, Intel's 6th generation overclock-friendly Skylake silicon and Nvidia's latest GTX 980M with 8 GB of GDDR5 VRAM and Thunderbolt 3.0 connectivity. The main drawback besides the LED racing lights, however, is the docking station. Now, we're used to docking stations that connect the laptop to a bigger display and peripherals, but this isn't that kind of party. This docking station provides liquid cooling for the CPU and GPU. Yes, Asus is ambitious enough to assume that whatever the consumer will be subjecting the already over-the-top internal specs to will require separate liquid cooling. Asus claims that when hooked up to the dock they'll achieve up to 80 per cent more performance over a fan-cooled machine running the same components. Obviously pricing and availability are a closely guarded secret at this point, but you can stalk and pester the manufacturer over at rog.asus.com





Sphero BB-8

The droid you're looking for ►

With the world going Star Wars crazy in anticipation of December's awakening of the Force, awesome toy maker Sphero is stoking the flames with the first non-Lego official toy from the movie. The BB8 droid is a new character and features heavily in the first trailer for *Star Wars: Episode VII The Force Awakens*, and is also, at the time of writing, undergoing rigorous testing at the PM offices. You can get a detailed explanation of the mechanics behind the droid's movement at howbb8works.com, and buy your own for R2 799 at thegadgetshop.co.za, or enter our online competition at popularmechanics.co.za



Huawei Mate S

To go boldly ▲

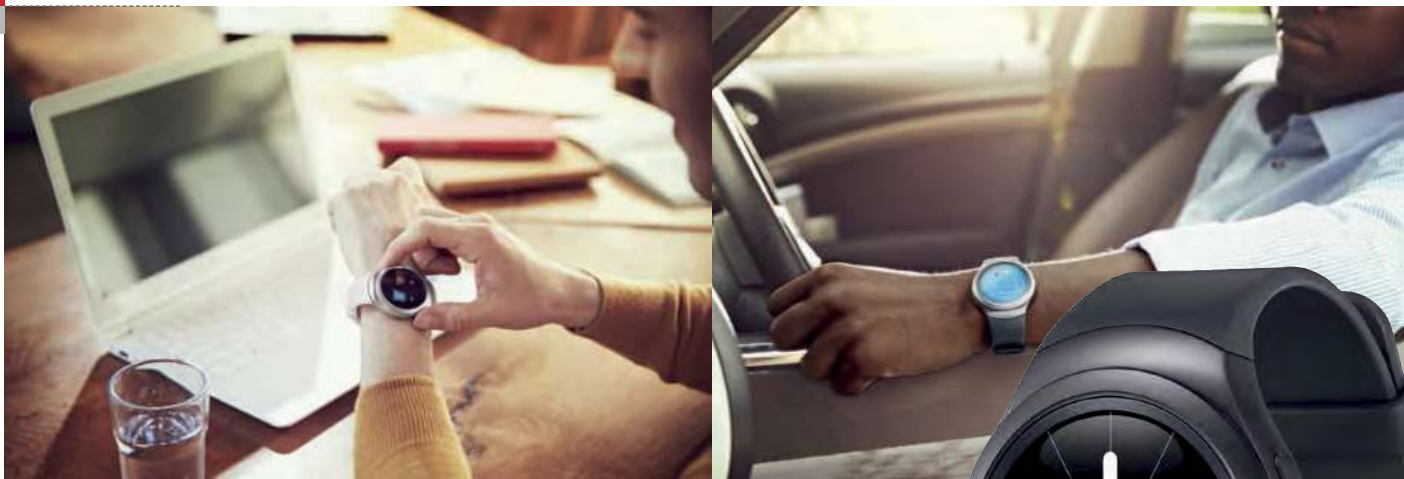
If you didn't know by now, Huawei Mate is to Huawei P series what Samsung's Galaxy Note line is to the Galaxy S line. So there's large overlap on internals. The main difference this time around is the smaller 5,5-inch (last year's Mate 7 was 6 inches) AMOLED screen in the Mate, with pressure-sensitive Force Touch technology in tow. The camera shares the same 13 MP sensor with optical image stabilisation set-up, but adds some nifty manual controls for shutter speed, ISO and exposure compensation. On selfie duty is the amazing 8 MP snapper with all the prerequisite panoramic modes. The clever fingerprint sensor round back stays from the Mate 7, but gains some new talents for swiping through a gallery and such. As is customary, the Mate S is slated for an early November local launch, but you can watch some product videos over at consumer.huawei.com



LG 65EF9800 OLED TV

Bright lights, bigger city ▲

The Koreans have teased us with this panel since January's CES and it seems the company is finally ready to release this demon into the world. Yes, we made a song and dance about the RGBW LED panel last month, but OLED is the future and this unit is the shining light. Think of OLED as having all the infinite refresh rate and perfect side angle viewing benefits of Plasma, without the weight, heat and inefficient energy use penalties. LG was also dolled up the smart features with the faster-loading WebOS 2.0, although it must be noted that Android smart TV operating systems are quicker and better. That said, you can't deny the awesomeness of the Magic Remote's point-and-click ease of use. Audio performance is stellar with Harman Kardon on speaker duty (it can also work as a stand), so you won't have to buy a separate soundbar, and the support for 4K as well as 3D mean you shouldn't be facing any video format problems for at least another year. Pricing will be confirmed in the coming weeks, but there'll be information over at lg.com/za



Samsung Gear S2

Wide open

Samsung's refusal to adopt Android Wear as its standard smartwatch platform is starting to bear unexpectedly tasty fruit. The Gear S2 is definitely not the company's first toe in the wearable water, but it does finally invite other brands to play in the grotto. Yes, that's a long way of saying the the Gear S2 will work with most other Android devices running 4.4 (KitKat) and up. And that's not all. Samsung's excellent S Health app has also been set free to play with other Android devices, which means one PM staffer can now claim Vitality points on any number of review devices passing through the office. Gear S2 can be seen as a reaction to Apple's Watch, but instead of a crown, Samsung has opted to make the bezel part of the touchscreen and button navigation control mix. The device runs on the company's own Tizen platform, but the Korean giant has managed to woo a few big time developers over to its side so the watch won't be sparse on apps. NFC is included for compatibility with Samsung Pay, there's a built-in optical heart rate monitor and there will be a SIM-enabled variant with GPS, too. Find out more at samsung.co.za





Sony Xperia Z5

Carry on my wayward son

While Sony continue to dominate the value for money-focused midrange smartphone market segment with the talented M4 Aqua and even better M5, the company has struggled to gain a foothold at the top of the food chain. We reckon, however, that the Z5 Compact will do some damage to competitor sales. In the Z5 family you get a choice of a Premium variant with a 5,5-inch 4K IPS display, a standard version with a more conventional 5,2-inch 1080p display and the Compact with a 4,6-inch 720p display. All share similar internals of 32 GB storage, Qualcomm Snapdragon 810

silicon, but the Compact backs it up with 2 GB RAM as opposed to the 3 GB on offer from the bigger siblings. The real story is Sony's clever placement of the fingerprint scanner in the power button and, of course, the all-new 23 MP main camera. With focus achieved in 0,3 seconds and the company talking up a big game about the low-light abilities, this is one device we can't wait to arrive for testing at the office. Further good news comes in the form of a reported near-stock Android 5.1.1 (Lollipop) experience and Sony's good software update track record ensures that users will feast on Marshmallow goodness shortly after Google's release as this issue goes to print. For more, visit sony.co.za

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TESTED

GARMIN Edge 25

Pocket monster

I'M NOT A CYCLIST, I ride bicycles. I don't particularly care about how much power I'm making because my legs are attached to my body and the burning tells me how much effort I'm putting in. But the metrics I am interested in are heart rate, distance, speed and elevation, and the Edge 25 tracks those exceptionally. For something barely bigger than the quarter-turn mount it sits on, Garmin has crammed in a lot of value. In the box you get no fewer than three mounting options, a heart rate strap (admittedly the bargain basement one with the long plastic bit) and the unit itself, complete with GPS talents and GLONASS assist. You can also pair a speed and cadence sensor to it to at least stay in touch with the data-hungry lycra brigade. Connect it to the aptly named Garmin Connect smartphone app (via Bluetooth) and you unlock the world of workout uploads (with sharing to the plethora of partner apps) and live segments. You can also upload courses and get on-device navigation for it. Dust and water ingress protection 6 and 7, respectively, round out the package and keep things running even when the rain is pouring down. GPS signal was quick to connect and the unit was able to pick out – and differentiate between – my 3 different ANT+ heart rate straps

without any hassle; although I won't suggest pairing a new sensor at the race start line. Controls come in the form of four buttons (Backlight, Select, Back and Down) and the menu system is intuitive, but having to mute the key and alert tones every time I used the device got tired very quickly. At a rand shy of R3 000 it's aimed squarely at simplified offerings from Wahoo and Bryton – and with this Garmin seems to have blown them out of the water. If only it would charge via micro USB and not the proprietary connector. – LINDSEY SCHUTTERS



JUST THE FACTS

SIZE	40 x 42 x 17 mm
CONNECTIVITY	GPS with GLONASS assist, Bluetooth 4.0, ANT+
BATTERY LIFE	up to 8 hours
PRICE	R2 999





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LINK 7 Oxygen Tank Wrench
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LINK 2 1/4" Box Wrench
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LINK 4 Cutting Hook
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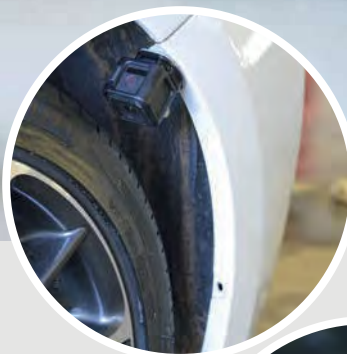


GoPro Hero4 Session

Making a splash

That GoPro has persisted with pretty much the same camera design since 2006 is a testament to its sheer market dominance, so it was no surprise that the company went a bit nuts when it unveiled the Session. I wasn't overly impressed in my first encounter with the new camera at the product launch, but spending a week documenting my rather mundane existence has left me amazed. The Session is small, so it's less obtrusive and it took my sharp-eyed 4-year-old a full three minutes before realising that there was something different to the school run. I also found myself wanting to mount the unit in increasingly adventurous places because of the compact design. In short, the combination of the Hero 4 Session and the GoPro smartphone app finally let me make sense of the appeal of an action camera. Shooting resolution is limited to 1440p because that allows for a more selfie-friendly 4:3 frame, which made perfect sense when I reviewed in-car footage of my traffic karaoke. That said, R6 000 is a lot to cough up for a non-essential item, but the compact dimensions does bring a new, ahem... angle to the competitive self-filming market. — LS

PM



JUST THE FACTS

MAX. VIDEO RESOLUTION	1920 x 1440 at 25 or 30 frames per second
MAX. STILL RESOLUTION	8 MP
BATTERY SIZE	1 000 mAh (approx. 2 hours continuous shooting)
PRICE	R6 400



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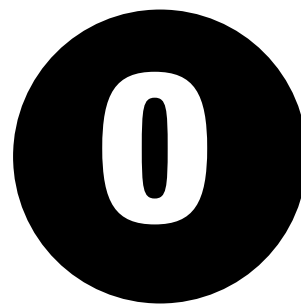
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THE FUTURE OF THE MODERN HOME

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OWNING A HOME grows more complicated every year. If you want to get the most out of your house in 2016, it's not going to be enough to simply fix the leaks, mow the lawn, and change a lightbulb now and then. You've got to try to understand the astonishing but confusing smart-home innovations that tumble along daily. You have to explore developments in energy efficiency, of which there have been many, but which are not simple. You have to keep your house and your family secure, but you wonder if the new high-tech security solutions make you more safe or – what with all the hackers out there – less. And, apparently, you might want to brush up on your knowledge of toilet technology while you're at it.

Fortunately for you, on the next 12 pages, we explore and demystify all this and more. And at the end, we address the opposite of adding technology to your home: taking your house apart and the surprises that can bring. So, dive in. Chances are you have some work to do. But it'll be worth it. You will go to bed at night confident that the walls around you are sound and secure, and you can return to the happy days when mowing the lawn and changing a lightbulb are all you need to do. Of course lightbulbs are very high-tech now, but we'll get to that in another issue.

BY

LUKE LUCAS





Whether you use just one or multiple units, the Flir FX video camera allows you to keep watch on your house from anywhere in the world.



DIY peace of mind

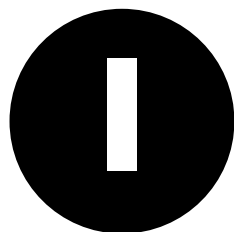
The past five years have done more for home security than the previous 50: smart cameras, smart locks, even smart guns. But how do you take advantage of it all? We tested just about every product on the market to find out.

PHOTOGRAPH BY PHILIP FRIEDMAN

The omniscient homeowner

Affordable wireless cameras have revolutionised home security and, for the author, being a parent.

BY DANIEL DUBNO



I prefer not to dwell on the smash-and-grab burglary in my home that traumatised me as a kid, but suffice it to say I wasn't left feeling very comfortable, both in our home's security and with the people responsible for securing it. (The police laughed when we insisted that they dust for prints.)

Years later, when someone stole laptops from the offices at the major broadcast network where I worked, many of us chipped in to help solve the crime. With camera technology so readily and cheaply available, we could scatter hidden cameras in smoke detectors, pens and key fobs around the office and wait for the criminals to return. So we did. And they did.

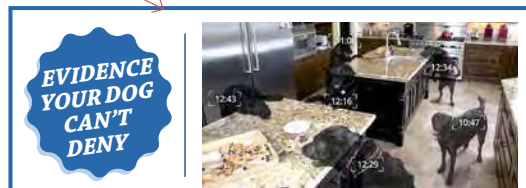
Recently I've enlisted the help of a new device: the Flir FX. Barely the size of an ice cube, the FX belongs to a new category of security cameras. It sits unobtrusively on my living-room bookshelf, observing all and revealing nothing – except to me. The Wi-Fi-equipped device records to Flir's cloud servers, which I can access through the app on my phone at any time. If it detects motion, it will send me an alert. The FX also has an infrared camera and illuminator for recording in total darkness, and if you unplug it, the camera becomes a remote video recorder with a four-hour battery life. You can even mount it to your car, and it will automatically record whenever it senses an impact of more than 1.7 g's.

What makes the FX truly exceptional, though, is its **RapidRecap** system, which lets you view a day's worth of footage in seconds. The system gathers all of the motion

that occurred in front of the camera and layers those video clips on top of one another, with a time stamp floating next to each potential delinquent. Hours after I set mine up, I heard wild panic and yelling from the living room, caused by a plump dove that had found its way through an open window and was circling over my screaming wife and son. Not quite the kind of home intruder I was after, but definitely worth watching a few dozen times.

If you enjoy watching people squirm, the way I do, you can also access the FX's intercom from your

phone, letting burglars know that they're enjoying their last few moments of freedom before the police arrive. I didn't use that function one night this summer, when the FX captured more than I bargained for: a late-night blowout thrown by my teenage children. I was surprised they were having a party without telling their parents. They were surprised we knew all about it. In hi-def. With a time stamp.



How to secure your home, 2015

According to your perceived level of threat.

THREAT LEVEL	LOW	MEDIUM	HIGH
SECURITY GOAL	To be notified of intruders or other risks – but mostly to spy on your cat.	To have a fully customisable system that monitors multiple security concerns.	To never have to think about security again.
WHAT YOU NEED	One security camera with multiple capabilities, such as the Canary	A security system cobbled together using various smart-home products.	A traditional system from a company such as ADT.
HOW IT WORKS	These compact, single-unit security systems come equipped with some combination of security essentials: a motion-sensing camera, night vision, audio recording and monitoring, a siren, and even air or temperature sensors. A live video feed is accessible via an app on your phone or tablet, and any motion or disturbance triggers an immediate alert. Some work with other third-party security devices, but these units are best used as stand-alone systems for apartments or homes that don't require much surveillance beyond that of a main entrance.	Think of this option as a home-security buffet. Smaller motion-detecting cameras, such as the Flir FX (see "The omniscient homeowner"), can be placed throughout the home and allow you remote viewing access. Easy-to-install motion sensors such as the Korner will sound an alarm and send you an alert if one detects movement at an entry point. Also falling under this category are smart lightbulbs you can remotely control, smart door locks that open via your phone's Bluetooth, and video doorbells that allow you to see who's at the door through an app.	DIY home-security technology has come a long way, but full-service security companies still provide the most robust protection. Their services are also expensive and come bundled in a two- or three-year contract that is nearly impossible to squirm out of. The good news is that most companies now have wireless options, which means no more holes in your newly renovated walls. Installation and monitoring come standard, so if you have serious safety concerns or a lot of space to cover, it's best to leave it to the pros.
SOMETHING TO CONSIDER	Some security cameras require you to pay for cloud video storage; others won't allow you to access live footage from your phone. Know what you're buying.	Owning smart security products from different manufacturers can leave you jumping between apps. The app IF is a third-party app that will help you streamline multiple smart products and accounts.	Because local security companies are often bought by the bigger players, quality can vary. Look for security signs around your neighbourhood to see which companies are popular.



The camera that remembers

The next big innovation in home-security cameras is facial recognition, but as we discovered with Netatmo's Welcome, there's room for improvement.

Netatmo's Welcome is a brilliant idea – in theory, anyway. The product is built around a motion-based camera that communicates via Wi-Fi with your smartphone, alerting you to the comings and goings at a chosen entry point in your house. The difference between the Welcome and similar connected security cameras is that Welcome is capable of facial recognition, so you can train it to alert you to specific people, such as your kid or someone it doesn't recognise, and not just to any motion.

Set-up is deceptively simple. Download the app, then plug in and flip over the camera, which includes 1080 p video, a microphone, night vision, and a distortion-correcting field of view. After it connects to your phone, Welcome captures video of any activity along with the six seconds of footage before it was triggered, accomplished by caching

video in its RAM. That stored video sits on the included eight gigabyte micro SD card, and Welcome deletes the oldest video when it runs out of space.

Unfortunately, the device is a slow learner. Even after I "taught" Welcome to identify my wife and son, it continued sending me notifications asking me to identify them. I came to think of it as a digital Inspector Clouseau – "Aha! Caught you!" – when it was just my son returning, again, from the town pool. There are settings to control notifications and even whom the camera records once it learns faces, but my patience ran out before that happened. After a week or so I unplugged the machine, figuring I'd use it when I go on holiday. Then, at least, Welcome's notifications are likely to be far less frequent, and far more welcome.

– DAVID HOWARD

FOR
THOSE WHO
PREFER WOOD-
TRIMMED
SECURITY



AN EVEN SIMPLER SOLUTION

As a single guy with no room-mates and a freight-car-sized apartment in New York City, I don't need much in the way of security – just something to tell me if someone has broken in, really. That's why the Withings Home has been perfect for me. Similar to security cameras like the Canary, the Home comes with a 1080 p motion-sensing camera capable of 135 degrees of viewing, a microphone, and an air sensor, which has already alerted

me several times to spikes in volatile air compounds. Good to know! My only gripes have to do with the image quality – a bit blurry – and the absence of an automatic timer to turn alerts off according to my daily schedule. I always forget to manually do that, which results in my iPhone chiming to show me the sandwich I just made two minutes ago. I do make a mean sandwich, but I don't need a recording of it.

– ANDREW
DEL COLLE

AN APP TO MAKE YOUR NEIGHBOURHOOD SAFER

Can digital community bulletin boards that connect neighbours across the country also prevent crime?

In these security-conscious times, many of us live our lives barricaded behind high walls and intruder detection systems – and sadly, personal interaction has suffered. It's often the case that we know people in faraway places better than we know our next-door neighbours. Ironically, the Web has come to the rescue.

Established as a way of linking communities, in 2014 OurHood started a

website targeting Green Point, Cape Town. Their aim: 45 neighbourhoods "live" by year-end. The actual number achieved was 10 times that. Soon afterwards, the OurHood app followed.

What are the thousands of OurHood members doing? They're posting, on a community noticeboard, about anything from lost dogs to tradesman referrals. They're also reporting events and infor-

mation – including crime, as it happens – as well as buying and selling.

According to *ourhood.co.za*, the idea was driven by the belief that connecting residents would help build stronger communities and, ultimately a safer, more inclusive society.

"Access to each OurHood group is limited to the residents of that neighbourhood. As such they are private, secure networks, and online privacy

is also vital," the site says. A strict sign-up protocol has to be followed.

In North America, Nextdoor is performing a similar function. Its connectedness has created a sort of virtual neighbourhood watch, with many Nextdoor communities even helping police solve crimes. For this reason, municipalities are starting to team up with Nextdoor, which can be useful for

quickly posting updates relevant to specific communities. But it's also creating a direct pipeline for citizens by assigning its community-oriented policing officers, who are already detailed to certain neighbourhoods, to maintain an active presence on the app, gleaning information and responding to citizens' questions or requests.

Is the house key doomed?

Smart locks are becoming increasingly popular, but will they ever completely eliminate house keys? SCHUYLER TOWNE, a lock expert and self-described security anthropologist, spends much of his time mulling over such questions. That is, when he's not testing his skills as one of America's top competitive lock pickers.

Are we living in a post-lock society? Most places are safe enough that home security isn't a huge concern, and in others, even the best locks aren't going to stop an intruder who really wants to break in. Locks are as much about portraying security as they are about actually keeping people out.

That might be why smart locks are taking off: they are mainly about convenience. The core feature of every smart lock is that you can open them with your phone, and they get smarter from there. But for the most part, they don't necessarily improve the cylinder or the overall security of your door (1).

I think a lot of future innovation in smart locks will be around key distribution. Digital locking and unlocking opens up possibilities. Imagine throwing a party and sending an invitation that is also a key to your apartment (2), or being able to give a babysitter a key that works only once. In fact, it might even lead to more secure behaviours, such as not having to leave a spare key under the flowerpot.

The catch is that sometimes manufacturers compromise the mechanics when they add electronics. Yale

Locks & Hardware once reintroduced an issue that had been solved a long time ago – its electronic locks could be picked with a paper clip. That's not good.

It's also true that power issues plague the industry. Aside from your phone possibly dying, a smart lock's digital features require electricity, and battery life has not improved since the first wave of products in the late 1990s. Ideally, if a smart lock runs out of power, it fails securely – it stays locked and can still be opened with a physical key. But isn't it ironic that the solution to a smart-lock failure is to rely on an old-fashioned key? You might end up putting one back under the flowerpot.

This is the sort of thing historians will laugh at me for, but I think in 50 years a kid will still know what a house key is. There are some innovations out there, like human-powered locks (3), that could prove me wrong, and fast. But I still feel more secure having a fully mechanical, non-digital lock (4). When I physically lock my door at night, I am comforted by that act. I don't think that's going away anytime soon. (See "Do it digitally", page 36)



1. Haven
One exception is Haven, a smart lock that bolts to the floor at the base of a door. When armed, it bars the door from the bottom. It's stronger than a deadbolt and ditches keys in favour of digital activation. Haven still has some hurdles – it only works on inward-swinging doors, for example – but its approach is probably the most interesting new idea in smart locks.



2. Lockitron
Lockitron might be the easiest lock to set up yet. It fits over your existing door lock, so you don't have to replace any hardware. That's important for the huge number of people who rent and are at the mercy of their landlord's skeleton key. The idea is so brilliant that the founders successfully crowd-sourced the money for their first manufacturing run.



3. Kaba Mas X-10
A big problem with electronic locks is power – what happens if the battery dies? Kaba Mas sells its X-lock only to the US Government, so the company has to make it secure and reliable. Kaba's solution: the twist of an input dial generates enough power to turn the lock on long enough for a pass code to be entered. Now it needs to get into consumer locks.



4. Suncnet AP501
No one lock has combined high security with the convenience of smart-lock features, but the Suncnet AP501 is almost there. It's keyless, offering keypad or keyfob access, and it's the toughest lock around. But it doesn't yet connect to a phone app, which will be crucial if it plans on competing with other, more popular smart locks.



Smart-home obsession

A cautionary tale.

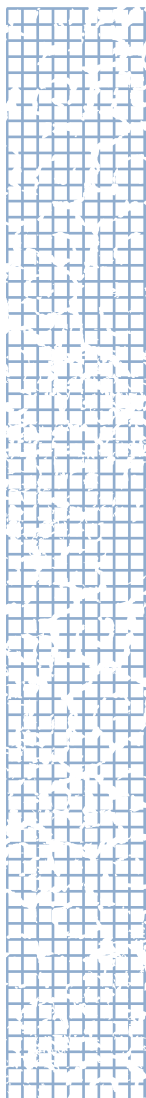
☉ The obsession started when I bought my first smart-home product. I have a weekend house, and I was always worried about whether I had left the heat on. So I picked up a Nest thermostat to control the temperature when I wasn't there. It was just amazing to me how well it worked. After that I had to buy every smart product known to man.

First was a Dropcam security camera, which is now owned by Nest, which is now owned by Google. I put it in my living room and was instantly fascinated with watching my empty house for hours, especially the birds outside. If a bird flew by the window, I'd get a notification and would sit in front of the computer at work and freak out. I even started feeding them. My second Dropcam I pointed at my driveway to keep an eye on the weather and anybody who would stop by. Then I would show my coworkers recorded footage of a guy clearing snow from my driveway, hoping they would think it was amazing.

From there I went to Nest's smoke detectors, a Kwikset Kevo smart-door lock, and Philips LED bulbs. Now I can remotely turn my lights on and off and even set timers. Why do I love looking at my house when I'm not there? I have no idea. Because I can, I guess. Because this is what sci-fi TV in the seventies promised we would be able to do, and now we can.

The coolest thing about the lights is that when my wife is at the house and I'm in the city, if she's not picking up her phone I use the app to put the light on strobe mode, like a Bat-Signal, and she knows to call me. In fact, my wife might be more obsessed than I am. I'm kind of okay now. I think.

– DAVID CURCURILO



HOW IT WORKS: ARMATIX IP1

- ③ Firing .22 LR bullets from a ten-round chamber, the iP1 relies on a linked rechargeable wrist-worn watch for activation. Communication between the watch and weapon are at radio frequencies that are resistant to interference.
- ③ The pistol has a blocking pin that will move only when it receives an authorisation signal from the watch. At more than 38 centimetres of separation between the two, the pin moves back into place and the gun won't fire.
- ③ The watch requires a personal identification number before the authorisation signal is sent. If the PIN is correct, "good" appears on the display, which also shows charge levels for the gun and watch.



ARMATIX

The plight of the smart gun

Technology to prevent gun accidents exists, so why isn't it widely available?

BY JOE PAPPALARDO

For decades inventors have been trying to make guns that can be fired only by their owners, without sacrificing reliability. Stuff industry types call them personalised weapons, but everyone else just calls them smart guns.

Most smart-gun prototypes so far have depended on biometrics (voice, palm, or fingerprint scans) to verify the owner, but none have made it to production. With the possibility of sweat or blood blocking a sensor,

dependability remains a concern.

That's why German gun-maker Armatix took a different approach with its iP1 smart gun. The iP1 uses radio-frequency identification to safeguard the weapon: as soon as the gun loses radio contact with its accompanying wristwatch, it automatically deactivates.

The main purpose of smart guns is safety. Accidental gunshot deaths are a cause for concern globally. According to Johns Hopkins University in the USA, unintentional

DO IT DIGITALLY

Keyless access isn't just for business premises

Yale's digital door lock uses a pin code instead of a key. Based around a high-security Yale Y3 nightlatch, it comes in a standard size and retrofits with most 60 mm nightlatches, so it should be an easy fit on timber doors. It's IP55 rated, which means it's dust- and water-resistant.

Once the lock is installed, you can personalise your PIN code using a number containing four to 12 digits. It can be reprogrammed whenever you want. A neat touch: you can also set up a separate visitor code to provide

access for family, guests or tradesmen. To foil would-be codebusters, the unit goes on a three-minute lockout if the code is entered incorrectly five times. A duress fake PIN feature can be used you believe you are being watched while keying in. Energy consumption is said to be low: it's rated to unlock up to 10 000 times on a set of AA batteries. Just in case, there's a low battery warning with emergency battery connection. When replacing batteries, PIN codes stay in memory.



PHOTOGRAPH BY IAN ALLEN

shootings are among the most preventable forms of gun violence. Presumably, smart guns could also deter gun theft and even protect police officers who lose their gun in a tussle.

But finding support for smart guns isn't as easy as it would seem. First, there's the politics. In the US, the National Rifle Association is notoriously prickly when it comes to anyone intervening in the gun market, so even safety technology is viewed as a potential threat. In fact, the only US store to carry the iP1 stopped selling it last year after receiving hate mail and an arson threat from gun rights activists.

Part of the reason for these fears is one tactless law. In 2002, the state of New Jersey passed the Childproof Handgun Law, mandating that gun sellers sell personalised weapons in the state only once there are smart-gun products for sale. This all-or-nothing approach has been polarising, so now the same politicians who passed the law are discussing how to repeal it in favour of tax incentives that promote smart guns.

Aside from politics, there's also the much larger issue: smart guns just might not make sense. The iP1, for example, accepts only .22 LR ammunition, which is fine for target shooting, but is too low a calibre for most who prize self-defence. Also, it costs the equivalent of a trio of new .40-calibre Glockes.

Armatix says it's working on larger-calibre versions of its pistols, and as with any new technology, prices tend to come down. But street credentials still matter, and that might come only from professionals. "The holy grail of smart guns is a large purchase order from a law-enforcement agency," says Stephen Teret, director of the Johns Hopkins Centre for Law and the Public's Health.

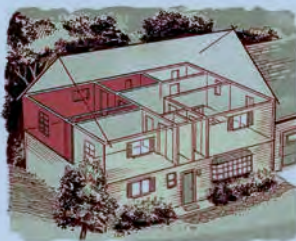
If lawmen adopt a firearm, it means they feel it's reliable enough for real-world use. Then the industry will follow. This is how the Colt .45 Peacemaker dominated the market in 1830 – by first selling to the Texas Rangers and then marketing to stagecoach riders. Until this happens, though, don't expect to see a smart gun at your local gun shop anytime soon.

ILLUSTRATIONS BY STEVE SANFORD

The improvised safe room

We're not saying you need a full-on panic room, but having a fortified space in your house to hide out in during an emergency is never a bad idea. Here's how to secure an existing room with minimal effort.

BY CAMERON JOHNSON



1. CHOOSE YOUR LOCATION

A room that everyone can get to quickly and fit in comfortably is ideal. Try to pick a space that has as few exposed interior walls as possible. If you live alone, a walk-in closet or bathroom is good. For families, a master bedroom works.



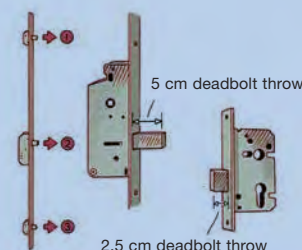
2. CONSIDER THE WINDOW

If your designated safe room is on an upper floor, having at least one window that fully opens is beneficial. A stashed-away escape ladder will allow you to exit if need be.



3. REINFORCE YOUR DOOR

Interior doors tend to have a hollow core and are easy to kick in. Replace yours with a solid wood door that uses pinned hinges and swings out. The extra resistance from the doorjamb will make it harder to kick in. When ordering the door, request it as a "slab", or non-prehung, and attach the hinges yourself.



4. GET A BETTER LOCK

The lock on a typical bedroom door can be opened by a sneeze. Upgrade to a three-point deadbolt with a five centimetre throw – that's the metal bar that fits into the jamb.



5. REINFORCE THE DOORJAMB

It doesn't matter how thick your door is if it can be forced open. Install a strike reinforcement along the jamb. The StrikeMaster II comes with 63 millimetre wood screws and a built-in strike plate that prevents the frame from shattering when kicked.

WHAT TO
KEEP INSIDE
YOUR SAFE
ROOM

PHONE: Calling the police is always the first priority. **CB RADIO:** For when there's no cellular signal or, more terrifying, the land-line's been cut. **ALARM KEYPAD:** If you have an alarm system in your home, an accessible keypad allows you to trigger alarms and call the authorities. **FIRST AID KIT:** All the standard materials, including any medications that you or a family member can't be without, like an inhaler or insulin. **DEFENCE WEAPON:** Gun, putter, something. **TOYS:** For the kids. **FOOD AND WATER:** Just in case.

Are we ready for a new toilet?



A dispatch from the front lines.

BY ANDY ISAACSON

water out of a retractable wand. With a remote control you can control the position, temperature and character – oscillating, pulsating – of the stream. A blast of warm air then buffs the area dry, a strange yet comforting sensation for a first-time user. The seat is ergonomically elevated about 40 centimetres from the floor, can be heated to between 29 and 36 degrees and is programmable like a coffeemaker. “Everything we know how to do is incorporated into this thing,” Krakoff says.

But Toto is proudest of what’s under the bonnet. As the lid opens, a mist wets the bowl to help prevent sticking. After each flush, two powerful jets create a whirlpool effect that washes the entire surface, and

In the summer of 2014 sewage workers in London toiled for four days to disgorge a “fatberg”, a congealed lump of food grease and wet wipes the length of a Boeing 747 that had become lodged in the city’s pipes. It was only the most revolting sign of a problem currently affecting many municipalities: debris caught in machinery at wastewater-treatment plants. Bathroom moist wipes, the squeegee to toilet paper’s buffing cloth, make up about a third of this debris. About 30 per cent of wipes are marketed as “flushable”, but clearly that does not mean degradable. New York City officials have reported spending more than R200 million during the past five years replacing and repairing sewer-plant pumps, gears, valves and screens damaged as a result of wipes.

According to global market research firm Mintel, sales of flushable wet wipes increased by 14,7 per cent from 2012 to 2014, while toilet paper sales increased only 1 per cent over the same period. People seem to have determined that toilet paper alone doesn’t do the job, turning to wet wipes to achieve the immaculate behind. Toilet paper companies, looking to sweep up new customers, have launched new, invigoratingly named brand offshoots to encourage them. As of 2012 there’s even a startup proffering vitamin E- and aloe-soaked sheets called Dude Wipes vacuum-packed in black. But with

homeowners installing smart thermostats and smart washing machines and smart toasters, might we trade in our sewer-clogging wipes for a high-concept toilet? We might, if the toilet industry could convince us it was worth the effort. After a successful TV campaign by Japanese toilet company Toto in the 1980s, bidet-style toilets are now more prevalent in Japanese households than microwaves.

A mustachioed, 30-year toilet company veteran given to wearing bowties, David Krakoff, president of Toto’s Americas sales division, believes that to persuade the country of the need for a high-performance john, you first have to show people what they’re missing. Last year, he attempted to show me in Toto’s Soho showroom, a spa-like haven with candles and cascading plants located between a Nike concept store and a Parisian clothing boutique on one of Manhattan’s trendiest streets. Here, it is not at all unusual for a sales associate to escort a grown man to the bathroom.

And what a bathroom it is. It features Toto’s latest and most impressive model yet, the Neorest 750H. Its lid opens and closes automatically – a feature Krakoff describes as a “marriage saver”. It has one of Toto’s famed bidet seats, which reduce the need for toilet paper by issuing



Water-efficient toilets such as the Toto Neorest 750H have modifications to the siphon, the trapway and the bowl that make water move across the bowl’s surface more quickly. The higher flow rate allows these toilets to move the same amount of waste with less overall water.

a mild bleach eliminates *E. coli*, cryptosporidium, and other harmful bacteria. The bowl is glazed with a hydrophilic, titanium-dioxide coating and zirconium ("Teflon times ten," says Krakoff) to slough off stubborn lime scale. Upon contact with sunlight, the coating triggers a photocatalytic process that breaks down organic substances. To kick off this process, an ultraviolet light in the lid activates after the lid is closed.

The Neorest 750H is what's known as an ultra-high-efficiency toilet, requiring only three litres of water to flush liquids, and four litres to flush solids. In the US, since 1992 all new toilets have been regulated to use less than six litres

per flush by that country's Department of Energy, but high- and ultra-high-efficiency toilets that use 20 per cent less water than standard models have been eligible to receive a voluntary specification from the Environment Protection Agency's WaterSense programme since 2007. As of 2013, more than 2 200 models of toilets have received efficiency labels from WaterSense, and more are being developed.

At American Standard's Product Design Centre in New Jersey, engineers analyse flushes using computational fluid-dynamics programs, as well as analogue tests in which "floaters, sinkers and semifloats", such as golf balls, ground-up maize cobs, and condoms stuffed with

brown miso paste are passed through stripped-down toilet bowls. ("None of us can stand miso soup anymore," says James Walsh, American Standard's vice president of chinaware.)

It is estimated that if every old, inefficient toilet in the US were replaced with a WaterSense-labelled model like the Neorest, it would save the country more than two trillion litres of water per year. A single family could save more than 50 000 litres per year. And while WaterSense has not specifically evaluated the effect of bidet toilets on paper use, Toto says that bidet seats require less paper overall, while effectively eliminating the need for wipes.

According to Plumbing Manufacturers International, however, only about 7 per cent of households have swapped their old toilets for high-efficiency versions, which is unsurprising given that they can be complicated to install. And though water-efficient toilets are equivalently priced to older models on average, Toto's Neorest 750H is around R135 000, and American Standard's AT200, which boasts many of the same bells and whistles, costs R57 000, leaving the cutting edge of toilet innovation far out of reach for most. What's more, these high-tech toilets require nearby electrical outlets – a pricey renovation that is considered dangerous in some countries.

There is another option: until the cost of the fanciest models comes down, which representatives from both Toto and American Standard estimate at a possible never, toilet companies are reaching out to the mainstream with scaled-back versions and add-ons. American Standard's AT100 electronic bidet seat, at R13 500, can be installed on an existing toilet. The Washlet, Toto's detachable bidet seat, costs a fraction of the Neorest. Kohler sells a R900 retrofit kit that can upgrade most ordinary toilets with the sensor-activated, touchless-flush technology that is integrated into its R86 000 Numi model.

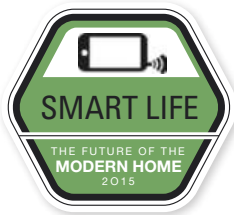
Meanwhile, waterworks and public works associations are working with INDA (the trade association of the non-woven-fabrics industry) to develop new flushability guidelines that will ensure that wipes labelled flushable are safe for sewer systems and wastewater-treatment facilities. A prototype wipe not yet on the market breaks up in water in less than 15 seconds. In a decade we could all be using compostable wipes or, better, detachable bidets. We may never scale the heights of bathroom hygiene established by countries like Japan, but, at the very least, maybe we can match the French.

AND A NEW RAZOR?



I have the same facial hair at 28 as I did at 13 – a Burt Reynolds moustache with splotches on my cheeks. That means I have to shave daily. I've tried everything – the triple-blade razors that my dad swore by, even an old-time Merkur safety razor. But then I tried a good electric razor. As in R4 700 good. My dad hated these things, said they never got close enough, but my Braun Series 9 gives me the same results as his Gillette, in 15 seconds. Yes, the process lacks the ceremony of a wet shave. But until I'm old enough to pull off the scruff that's in right now, I'm going to use my morning routine for important stuff, like looking at motorcycles on Instagram.
– ALEXANDER GEORGE

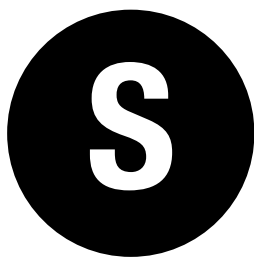




Get smart

Bringing home intelligence
needn't be an expensive
business

BY ANTHONY DOMAN



Smart homes: sounds expensive. Complicated. But in fact they can be surprisingly simple.

The new smart home is to the old automated home like smartphone apps are to suites of computer programmes. Instead of a one-size-fits-all system controlled by instructions from a central processor, the new smart home is based around intelligent sensors feeding into and creating a smart network that both informs and reacts.

To find out how the new smart home will work we spoke to Paul Davidson, whose company Urbantek (urbantek.com) designs and consults in the area of smart homes. With a background in IT, notably network infrastructure and design, he's well versed in the thinking around the Internet of Things. His co-founder, Graeme Hook, brings experience in software and integration, allowing them to bridge the gap between devices and systems. Urbantek (slogan: "Home is where the smart is") distributes the Fibaro range of smart systems, which plays in the same space that Nest has occupied successfully in places like North America.

Davidson holds up a white plastic object about the size of a powder compact. And compact is, of course, the word. "Previous systems were typically quite bulky and quite invasive. This sensor detects moisture

on the floor and can be integrated with the plumbing hardware. Now we've got the ability to put this in a bathroom. Should there be a leak detected or, as happened with my kids twice last year, they let the bath overflow and flooded the bathroom, in that situation we can now shut the water down."

Smart or intelligent homes are still seen as something pricey and super-luxury. The likes of Davidson are working hard to change this perception. They dipped their toes in the water at the Homemakers Expo and found a definite demographic that is aware of it: "The high end. But there is a bigger group that believes there is a lot more effort involved in activating it. We say this fits very much into the middle market."

Comparing current off-the-shelf prices can be illuminating. "The average guy is going to pay for a passive infrared sensor, say, R600 to R1 000. The Fibaro equivalent unit is R900. But the difference with our unit is that it is multifunctional. It is able to measure temperature. It is able to measure light. And it is able to be armed."

That means it can serve as environment monitor as well as movement – hence intruder – detection.

Will it talk to existing functionalities?

"There are various systems in general use locally: DSC, Zwave, Paradox. We already have some integration with DSC systems

The new smart home is based around intelligent sensors feeding into, and creating, a smart network that both informs and reacts. Right: Customers don't just want multi-room media, they want it integrated with smart home systems, too.





FIBARO



and we are writing the necessary interface for Paradox.”

It’s about a lot more than intruder detection, too. A typical make-or-break door contact activates an alarm when opened, indicating an intruder. Using smart systems, the door contact can be used to trigger a sequence of events.

Enter a room and automatically turn on the lights or close the security shutters, for example. Opening the garage door can be programmed to light up the access staircase after dark.

Conventional sensor alerts can be enhanced. “A smoke detector can act as a trigger to a sequence of events, instead of being just an alert. “I can say, if that is triggered above my stove, I want you to shut down my stove. I want you to vent – put the extractor fan on – I want you to notify me and notify the emergency services. I can choose what I want to be notified about.”

A smart home can also feed into awareness of energy consumption. “With our downstairs bathroom, it doesn’t have a window, it has an extractor fan. But we find typically people leave that on. We’ve got a sensor on the door and a motion sensor, so that when you enter, it will switch on the light and the fan. When you leave, it will switch off the light and leave the fan running for five minutes.”

With load shedding very much part of South Africans’ lifestyles, there’s added relevance for smart systems. “We are able to measure energy draw at individual components, so if you have load shedding and you need emergency lighting and certain functions in your home that you want to happen, this system will determine what it needs to shut down immediately.”

So at one extremity we have the smart sensor; in the middle, we have the home centre; and flowing from that, we have the programmed sequence of events – which might involve some significant costs in hardware interfaces such as electrical relays

or plumbing hardware. "On the electrical side we put in a bypass circuit. We have had to source fairly high-end, high-quality and safe components and wire the bypass circuit in. But that's it. We don't have to be any more invasive than that."

Urbantek is increasingly getting involved at the planning stage of homebuilding. "We get a plan, the foundations are about to be cast and the typical things are, what do we have to conduit? Where do we have to conduit? Because of wireless limitations, unfortunately we have to have conduiting."

A lot of what they do involves the obvious – multimedia and CCTV. But increasingly the industry is moving towards integration of home systems. "We might, say, look at pool heating. What we are currently exploring is the traditional solar idea concept of heating a pool with the black pipes. At certain times of the day it is more effective and at other times less. So we are able to look at that and recirculate or just shut it down. We can start doing more intelligent things."

The booming interest in streaming media is driving the integration of smart home systems. "The big thing now is that people want to be able to stream media throughout the house. They want to be able to get content, but independently, from the same piece of equipment."

The control for that streaming media – and by extension the home systems – lies in software, which



Everything from CCTV to automated home systems such as irrigation can be monitored and managed using standard mobile devices and video displays.

can go on an Android or Apple mobile device. "You don't require any extra hardwired panels. You can take older-generation mobile devices, too. We use a previous-generation iPad in a wall mount and with that, you can monitor your CCTVs, manage multimedia and activate the roller blinds and shutters."

The starter kit incorporates a smoke sensor, flood sensor, door contact, motion sensor and automated AC mains plug, for about R8 000. It's all controlled by a surprisingly compact "home centre", which currently comes in two sizes, both capable of managing 220 devices. The more powerful, bigger home centre (R10 000) has the same capacity, but offers more sophisticated messaging and more options to control scenes.

"Let's say your good night

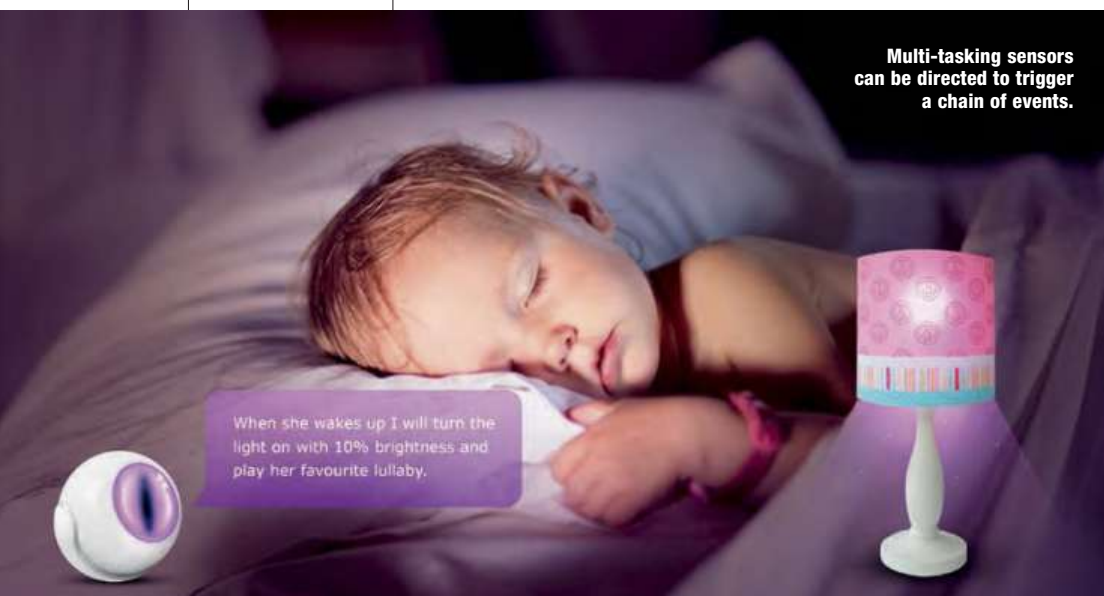
scene or wakeup scene. You can start automating tasks using a motion sensor."

And you can tell any device to be a trigger. "If you have an irrigation control system, it can connect to a weather service. If there's rain on the way, you can opt to not irrigate for X days. Then we are moving into smart irrigation, where we are working on a probe that measures levels of moisture in the soil."

Where would the prospective smart homeowner start? "It really depends on your vision. And, of course, on the size of your home. In a townhouse, the starter kit would be a good place to start."

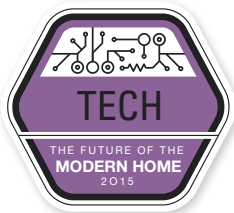
How does Fibaro differ from whatever else is out there? What about the risk of ending up in a dead end, locked into a particular ecosystem?

Networking and operational protocols do, apparently, have significant interoperability. "There are some similarities. Fibaro's approach has been, no retrofitting required. Each component makes up a MESH network, so that it becomes the greater network." Each component will extend the reach and become aware. "They build awareness of each other. I can even switch the home centre off and the sensors are still aware of each other. They know what to do." Fibaro's approach has been to operate on the basis of an open API. "And a lot of it integrates seamlessly. Nest integrates with this system and vice versa. We don't necessarily have equal functionality, but there is a lot of cross-use. There is much more collaboration."



Multi-tasking sensors can be directed to trigger a chain of events.

When she wakes up I will turn the light on with 10% brightness and play her favourite lullaby.



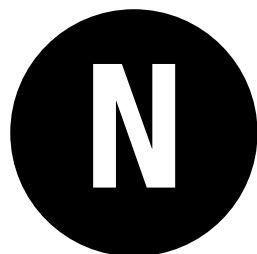
For an entirely different take on audio, Devialet launches the Phantom

BY ANTHONY DOMAN

The sound of tomorrow



The name Devialet refers to *Sieur de Viallet*, engineer and companion of one of the leading lights of the Enlightenment, Diderot.



Not content with having effectively declared discrete amplifiers and digital processors obsolete by combining digital and analogue technologies, Devialet is now taking aim at the separate speaker. At the same time, the French company is moving into the more affordable end of the market (Devialet amplifiers range from the equivalent of R90 000 to well north of R400 000).

You stream content via Wi-Fi from your mobile device or PC to your Phantom, controlling it using Devialet's Spark app. Up to 24 Phantoms can be networked using



the company's Dialog controller.

"Your Phantoms will recognise each other, synchronise and multiply spatially the acoustic experience," says Devialet. Users connected to the same Wi-Fi network can interact with each other and create a collaborative playlist in real time, each having access to the other's music.

The Phantom isn't just a glorified docking station, though. According to Devialet, the Phantom emits sound through a revolutionary new process. Its technology is covered by 88 patents, among which is Heart Bass Implosion, specifically designed for the Phantom. Devialet says it goes beyond the limits of common speakers, allowing "ultra-dense sounds thanks to lateral beats under very high pressure".

And its rounded form isn't just for aesthetics, apparently: it was chosen for optimum omnidirectional sound emission. Like the company's other components, the Phantom is based on a platform that allows for free upgrades as improvements become available.

PM



PHANTOM SPECIFICATION

PROCESSOR	800 MB dual core
OUTPUT (W)	750; Silver 3 000
SPL (dB at 1 m)	99; Silver 105
BANDWIDTH	16 Hz to 25 kHz +/- 2 dB
D/A CONVERTER	TI PCM1798 24 bits/192 kHz
DIMENSIONS	253 x 255 x 343 mm
WEIGHT	11 kg
MATERIALS	Composite shell, aluminium core
DRIVERS	Aluminium dome
CONNECTIVITY	Dual-band Wi-Fi, Ethernet, Homeplug PLC, optical
PRICE	From R33 000



THE MASTER

RIDLEY SCOTT

is one of the most ambitious and successful directors of our time. In a 50-year career - *Alien*, *Blade Runner*, *Thelma & Louise*, *Gladiator*, *Black Hawk Down*, *American Gangster*, *Exodus: Gods and Kings* - he has created astonishing worlds that challenge the limits of endurance and possibility, but never reality. With his new film, *The Martian*, Scott adds a new dimension to his legacy: Science, a frequent backdrop to the stories he tells, becomes a main character.

BY TOM
CHIARELLA



WHEN YOU STAND ON MARS, it's hard to figure the horizon. It looks a smidge too close, disconcertingly dim. Dark even. The colour of the sky above you? Sort of blue, with a green tinge. It's vast, unlike any place else you've seen. Distance is the first puzzle of this place. Point A to point B stuff. How to judge? You spitball it. How far could you throw a baseball here? Or drive a golf ball? What about repeated Frisbee throws? How far would it have to go before you hit some obstacle? A wall, a drop-off, whatever is out there. Everybody knows things sail on Mars, so you could really drive that golf ball. But the soil would be a problem. While it's just as red as you might expect, it's also sandy, loose, and untamped by gravity. Whatever you threw, whatever you struck or hurled, when it hit the Martian surface, it wouldn't roll. Mars has no roll.

Not this Mars anyway. This place is a construction, a cinematic vision built on one of the world's largest soundstages, outside Budapest, Hungary. There's a red-dirt floor – composed of 2 400 cubic tons of soil mixed and remixed to match the texture and hue of Wadi Rum in Jordan, where the exterior scenes were shot – and a nearly abandoned astronaut habitat in the distance. This is where Ridley Scott is shooting a large portion of *The Martian*, starring Matt Damon as a NASA astronaut stranded on Mars after an emergency evacuation.

Scott, who has previously crafted notable science-fiction movies of the first order (*Alien* and *Blade Runner*) and at least one of the other order (*Prometheus*) stands

working the problem of the day, as he is wont, hunched over a bank of playback monitors. He's 77, looks younger. White-bearded and still has some red in his hair, cosy in a fleece jacket. His boots, more than anyone's here, are skinned in a fine, red Martian dust, and his ball cap is on the table. Scott is not imperious when he works. He doesn't prowl the soundstage. He's its pivot point. More foreman than auteur. Scott will glance to make eye contact, but

refuses to cast about for it. You either look right at him or you don't. You're one kind or the other. He doesn't need any favours or new pals. The man is a knight of the realm, after all. There's a businesslike urgency in his voice, and a muted though undeniable enthusiasm for detail, which you are assumed to share. Concocting a story through film is surely a kind of puzzle. Concocting a planet to tell it is more like architectural engineering.



When Ridley Scott works, you see only his back, bent low, as he stares intently into the monitor, giving notes. Eventually Scott speaks over his shoulder. There's no message in the gesture – this is simply Ridley Scott on the job. Quiet. Undistracted. Calculating. The crew knows he is present. A soundstage is always quiet, built to be a place where extraneous noise goes to die, and Scott makes the whole place even more quiet when he's working. His lieutenants – department directors, assistant director, cinematographer – are quite often Ridley Scott lifers, who untangle every twist and interpretation – camera position, lens, lighting, pitch and yaw of the shot rotation – alongside him. When he's not quite happy, Scott asks for another take. When he's happy, he asks for another to see what it might bring. He points to the position of a light bank, yammers with his assistant director before straightening up to regard the rotation pattern of three cameras used for this one shot, each tracked to gyroscope around the exterior portion of a

hatch. From the hatch, in this moment in the film, an astronaut will face the stark light from the Sun and the distances – grand and small – across space. Three cameras, whirling in coursing, steady arcs. Arms folded now, Scott assesses the scene: "This is an important moment," he says. "It matters to the story and the character. I like multiple cameras here because space has a jarring quality at this moment. The man is very still, but this ship is in orbit. It tips and moves, and it isn't ideal for rescue. It's just highly disorienting to poke your head out, even into daylight."

It's an 11-second shot in the movie. It's taken hours to set up



Far left: The three-time Oscar nominee directs Matt Damon in Wadi Rum, Jordan, where *Lawrence of Arabia* was also filmed. **Left:** The soundstage version of NASA. **Below:** Damon on the set in Budapest, Hungary.

and another hour or two to shoot. They've run it twice already. "One more," he declares. And maybe one more after that.

F or Scott, it begins with a pencil. "My editorial process is simply drawing. I'm a paper-and-pencil man. I love to draw, and I use it as a means of seeing a story from its beginning to its end. I just draw panel after panel, until I can start to see the place and the character set against it. I tried to draw each problem Watney was faced with, until I could really see the planet in front of him, the technology he lives in, and see him set within the incredible isolation of both."

Scott has directed 22 commercial films since 1977, and while nobody in the real world judges a person by his movie gross, it should be said that Scott has grossed more than R17 billion on his films in the US alone. More to the point, he's never failed to vary the genre, setting, or historical time period of the films he chooses to make. *Alien*, *Blade Runner*, *Thelma & Louise*, *Gladiator*, *GI Jane*, *Matchstick Men*, *Black Hawk Down*, *American Gangster*, *Prometheus*, *Exodus: Gods and Men*. Many of his films are cultural touchstones, rich atmospheric gems, featuring surprisingly strong women (think Ripley, Pris, Thelma and/or Louise, GI Jane herself) and signature moments (xenomorph in the air vent, the fingertips of the gladiator brushing the wheat on his farm, the dark chaos of Mogadishu). Scott's imprint is on the life and commerce of the stories we love, none the same as the last or the next. If *Prometheus* lurched from the gritty realism of *Alien*, *The Martian* claims a space of its own in science fiction – a near-future proposition in which the limits and capabilities of existing technologies become essential plot points. No warp drive. No wormholes. No grand speculation.

Early on, Damon's character,

Mark Watney, declares that he will have to "science the shit out of this" if he hopes to survive. That's the bet of the movie, that science itself – accurately portrayed, unceasingly up-to-date science – can be used to create the tension, suspense and existential dread of a great castaway story. Scott and *The Martian* are going to science the shit out of that story, and bet that we can all keep up.

Scott's father was a lifelong officer in the British Royal Engineers, which might be an easy explanation for the habit of sussing out problems with that pencil and paper. It's not that simple, however. "My mother was the real sergeant major of the family," Scott says. "She made sure that we confronted jobs and figured them out. Fixing things, making our own repairs, darning socks. We were asked to figure out the mechanics of a problem and solve it by our own selves."

Similarly, Scott trusts the people he's hired to solve the problems of the story. Many of them have worked with him for 30 years. "When we filmed *Gladiator*, I had a department responsible for creating these catapults for the opening battle sequence. They had to really work. We needed them to create an inferno of fear. We knew that the actual catapults used by the Roman army could throw burning-hot paraffin wax at the enemy. Building a full-size catapult is quite an undertaking," Scott says. "But the catapult we built threw the wax 70 metres. I think." He ho-hums the shortfall. "It says more about the magnificent Roman engineering than any failure on our part. Detail is essential. Even so, you can't get held up by it."

Scott will talk propulsion systems, on-site hydrogen collection and launch capability with the best of them. It feels important to understand. And fun. The sweep of his career shows that. A reverence for the wealth of things we're capable of creating. Chariots. Con games. Deep-space transport. Crime syndicates. Replicant technology. Road trips. Every story an exploration of capabilities and limits and the means by which we exceed them. Or fail to. "Watney is locked on Mars by the genius of technology. As advanced as it is, it's still a limited inventory, which he assesses constantly as it breaks down, gets used up, falls apart." And like any storyteller, Scott sees character as a story's most detailed construction. Take Watney: "His ingenuity, his scientific understanding – that's what frees him from the original function of what he's been left with. Look at how he farms."

As efforts towards rescue pick up on Earth, Watney, a trained botanist, must develop a way to continually farm enough potatoes to live on, even though Martian soil is incapable of growing anything. To create functional soil, Watney turns to what no one would want: the human faeces stored in vacuum packs by NASA for the planned return to Earth. "NASA collects, vacuum seals and labels every bit of solid human waste. The plan is that once the astronauts get home, scientists unseal it and study what it shows about the effects of space travel on the body. It's very businesslike," Scott says. "Watney creates a farm out of it right in his own living space. It's quite advanced in terms of science and process, and yet it's got a primitive point on it."

"The exploration of Mars is not unlike a pioneer jour-



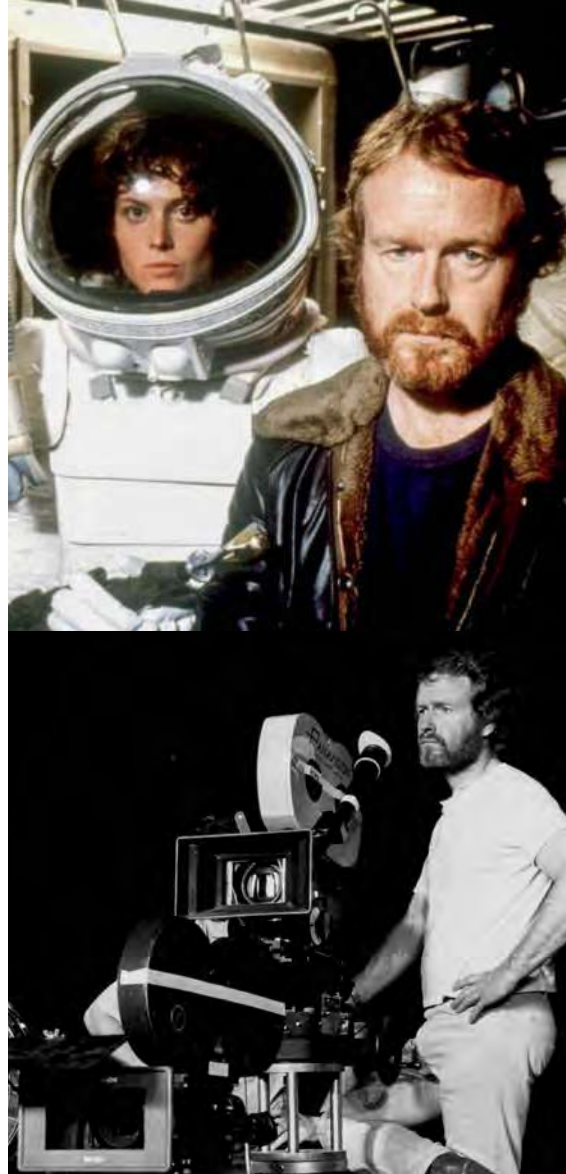
MARTIANS IN POPULAR CULTURE

			Threat to humans	Vulnerability
1897	WAR OF THE WORLDS		high	• Human bacteria
1948	MARVIN THE MARTIAN		moderate	• Bugs Bunny, Michael Jordan
1950	THE MARTIAN CHRONICLES		low	• Germs
1963	MY FAVORITE MARTIAN		low	• Detective Brennan
1976	THE FACE ON MARS		low	• Higher-resolution photography
1990	TOTAL RECALL		moderate	• Tri-breasted women
1996	MARS ATTACKS!		high	• The falsetto yodelling of Slim Whitman
2012	JOHN CARTER		high	• Tim Riggins
2015	THE MARTIAN		low	• Needs food, oxygen and a risky experiment to live

Left: Scott on the set of *Blade Runner* with Harrison Ford in 1981. The film is widely praised for its inventive effects technology, much of which was done by shooting different elements of the same scene, over and over, and then layering them on top of one another. Right: On the set of *Alien* with Sigourney Weaver in 1978. Bottom right: Behind the camera for *Alien*.

ney in the American West,” Scott says. “When wagon trains went out from the East, the distance they had to travel was the only given. A known quantity. Getting there, stopping at the right spot for the night, finding drinking water – these were the difficulties. Scouts were the highest-paid members of a trip because they would ride ahead, examine the obstacles – rivers, mountain ranges, native populations. They were the most knowledgeable, inventive, ingenious individuals available. Astronauts are our scouts. Watney has a bit of Kit Carson in him,” Scott says, referencing the legendary 19th-century American frontiersman. “He’s funny. He’s capable. He fights to live in the wild. Watney is one part entertainer, one part athlete. Even a kind of survivalist. Carson was all that. Watney is a little glib and even fatalistic, in the face of what he has to do. He’s not feeling sorry for himself. It’s really sort of American, I suppose.” Ask the castaway himself: Matt Damon, scraggly-bearded and a little gaunt, there on the far side of Budapest, on this Mars. “One of the puzzles for Ridley was creating a sense of the terror of being a hundred million miles from another human being and still allowing it to be funny. Acting is all about the other person, what’s going on with them, what they present to you,” Damon says during a break in shooting. He gestures towards the soundstage. “Here, the character has only himself. I came to see the only other person really was Ridley.”

Damon is wearing his spacesuit, sitting on a long folding table, his gloved hand a finger away from a bag of potato chips left over from the craft table. “But the movie is way more than a castaway story. That’s what Ridley does. There’s this whole other side of the story. I think there are 55 actors in this movie.



SCOTT WILL TALK PROPULSION SYSTEMS, ON-SITE HYDROGEN COLLECTION, AND LAUNCH CAPABILITY WITH THE BEST OF THEM.

It’s like they shot three separate movies on three separate parts of the planet. It’s the entirety of everybody working to come get him. It’s a rescue story, too.”

On the complications of pulling together such a story, Scott is preternaturally chill. (Knight of the realm!) He’s done it two dozen times – mixing the levels of storytelling, breaking the job into discrete tasks, assessing a means to reproduce the tension of a human circumstance even in an inhuman place. “I think of the movie as having four separate universes. There’s NASA, there’s JPL [NASA’s Jet Propulsion Laboratory], there’s the story of the crew on the ship and then there’s the story on

the surface, the Robinson Crusoe story. So the key thing is that it has to be funny, or else the sheer wealth of information starts to feel overwhelming.”

This may be the thing that makes it positively cool to talk with Ridley Scott. Yes, there’s the elegant demeanour. Notable. Very nice. But most of all, Ridley Scott is an enthusiast. He loves a problem. He takes to a set of characters and revels in the way they confront their problems. Ripley solves a dozen on the way to her escape vessel, then half a dozen more. Thelma and Louise run from, and then into, their problems. Joyfully. Consider the gladiator, parsed by loyalty, by duty, by love. And now the one man, the astronaut and his measly bag of potatoes, and the millions of kilometres of space between the place he finds himself and his home. Problems. Imperfect people, fully drawn. Seen. And what Ridley Scott sees, Ridley Scott draws.

On another part of this Mars, they are blowing the hatch. It’s a low-level effect, a small, controlled explosion performed at the end of the usable life of the lander-module component. A number of crew members have gathered to watch. Earplugs are distributed. Ridley Scott takes a quick look from the doorway and then moves on before they get to the actual explosion.

Filming is near its end on the soundstage. The hallways are dusted in red. Red

footprints lead from food to banks of clipboards and then to the world outside. Sets are being broken down for storage. In every corner boxes of innocuous riggings and spare parts – clamps, rods, pads. This may be Ridley Scott’s last look at this Mars. He’s off to Jordan in the morning to finish shooting. The disassembly of this operation echoes the story it tells.

“At the very end, when it’s evident Watney will be leaving one way or another, he sort of goes on a walk-about, because bizarrely he’s become fond of this environment,” Scott says. “And if we tell it right, people will get that about him. He’s cleaning up, taking care of the assets for the next party, creating assets for the next person. He’s been trained. He’s an astronaut.”

Then Ridley Scott carries on, down the dusty hallways. An assistant joins him, passes a message, and they change direction to another part of that world. You’re looking at his back again, which means there’s still work left to do, on this Mars and beyond.

MARS → THE SCIEN



WHO WILL GET THERE FIRST?

A relatively unbiased analysis of the groups attempting to reach Mars, with real Vegas odds on their success by **Raphael Esparza** of *docsports.com*.



RUSSIAN FEDERAL SPACE AGENCY

Russia announced a rocket that can move heavier payloads than any rocket currently in operation. According to President Vladimir Putin, in 2018 Russia will use this technology to launch the first manned missions from the motherland. (They typically launch from Kazakhstan.)

Vegas odds: 60:1. "It's clear that Putin is serious."



INSPIRATION MARS

Unlike the other organisations on this list, Inspiration Mars – led by Dennis Tito, the first tourist to go to space (for only \$20 million) – doesn't plan to leave people on Mars. What it does plan to do is take advantage of a rare planetary alignment that will occur in 2021 to allow a pair of astronauts to fly by both Mars and Venus on a trip that lasts a mere 582 days. **Vegas odds: 25:1.** "If they don't actually touch down on Mars, does it count?"

CHINA NATIONAL SPACE ADMINISTRATION

China didn't send a man to space until 2003, but they've been aggressive ever since. They're building an orbiting space station and looking to launch a rover to Mars in 2020. One of their taikonauts – what they call astronauts – was part of the Mars500 study in Moscow that tested long-term isolation in preparation for a long journey to the Red Planet. Their current plan is for a manned Mars mission between 2040 and 2060.

Vegas odds: 100:1. "They are late to the party."



SPACEX

Elon Musk wants to go to Mars, and he's built a company with the experience to do it. The contracts with NASA for supply runs are old news. SpaceX has moved on to experiments with recoverable rockets and GPS-guided landing platforms. Musk has already announced his intention to reveal the company's Mars Colonial Transporter before the end of the year. He says they have a spacesuit in the works, too. **Vegas odds: 5:1.** "They have the desire and the funds."

NASA Although the low Earth orbit shuttle programme was shuttered in 2011, NASA is at work on a new system of vehicles to take the next generation of missions into more distant orbit. The Space Launch System is a massive rocket that will propel an all-new manned spacecraft called Orion to near-Earth asteroids to develop the knowledge and skills to make possible a trip to Mars, which the agency estimates will occur in the 2030s.

Vegas odds: 80:1. "If it weren't for the budget cuts, NASA would be the favourite."



EUROPEAN SPACE AGENCY

European governments currently have bigger concerns than outer space. **Vegas odds: 300:1.** "They may have teamed up with Russia to launch a Mars orbiter mission in 2016 and a rover in 2018, but even with help, I don't see Europe being the first."

MARS ONE Mars One offers one-way trips to the Red Planet, funded by broadcast advertising revenue brought in by its proposed reality show. The organisation plans to use a series of missions starting in 2020 both to build up infrastructure and prove its technology before sending the first manned crew in 2026. From everything we can tell, it's a total scam. **Vegas odds: 15:1.** "If they do any of the stuff they claim they will, the group would be a huge sleeper."

THE MARS SOCIETY A major proponent of colonisation, the Mars Society advocates a two-stage plan called Mars Direct. First, an unmanned craft journeys to Mars and generates rocket propellant by reacting hydrogen with the Martian atmosphere. A follow-up manned mission then arrives with a fabricated living space. The crew uses the living space as a base for exploration before taking the first ship back to Earth, leaving the living space behind. A few such cycles build up a stock of habitats on the planet – and the beginnings of a Martian city. **Vegas odds: 9:1.** "No other group has as well-detailed a plan."

TIFIC COMPANION



HOW WE SEND SPACECRAFT TO MARS TODAY . . .

The satellites and rovers that have already been to Mars were sent with two types of orbital manoeuvres: Hohmann transfer and ballistic capture.

1

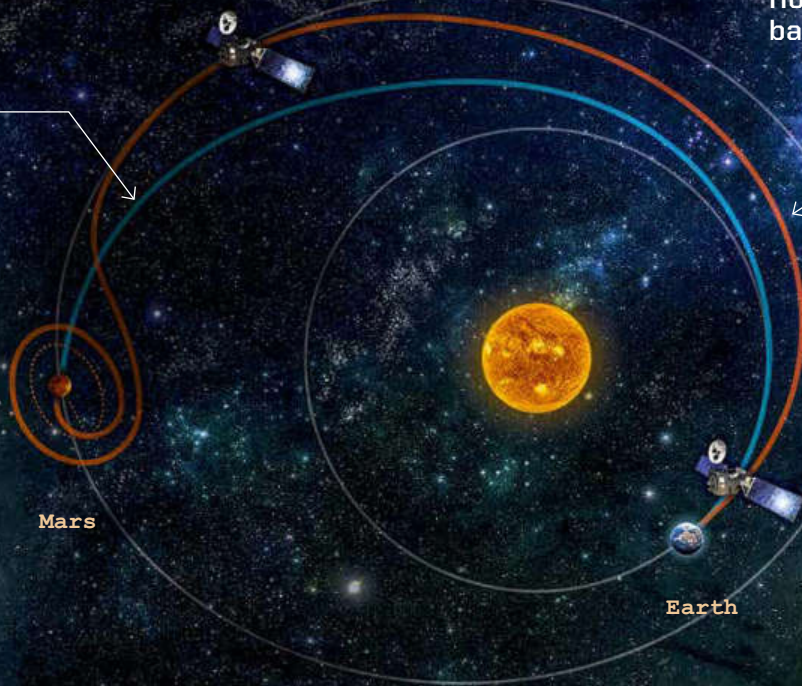
Hohmann transfer

This classic method launches a craft to meet Mars directly in its trajectory. It's not ideal because it requires a lot of fuel. The craft has to slam on the brakes to avoid flying past Mars and getting lost in space.

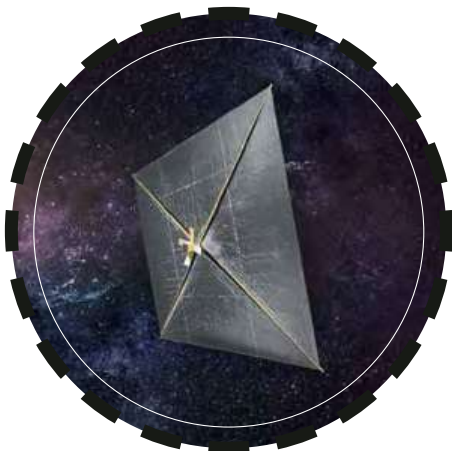
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Ballistic capture

The spacecraft is launched ahead of Mars on its orbital path. When Mars catches up, the craft is captured in the planet's gravitational pull. Although slower than a Hohmann transfer, this method uses much less fuel.



...AND HOW THOSE TRIPS MIGHT BE POWERED IN THE FUTURE



➡ **SOLAR WIND SAIL** In space the massless photons that make up the Sun's radiation have the same effect as wind on Earth. They constantly buffet spacecraft, so much so that NASA regularly corrects its trajectories for solar radiation. Instead of fighting that radiation, spacecraft can take advantage of it by incorporating a thin sail made of carbon fibre or aluminium-reinforced Mylar that propels the craft using the energy of the photons (left). With no need for expensive chemical fuel, solar sails offer a much cheaper alternative to traditional means of propulsion.

➡ NUCLEAR THERMAL ROCKET

A nuclear reactor is used to superheat hydrogen, which, as the molecules expand, is forced through a small area to generate thrust. It does the same job as a chemical rocket, but uses about half as much fuel.

➡ **ION THRUSTER** Ten times more efficient than a traditional chemical thruster, an ion thruster is suited to long-distance missions. You know, like a trip to Mars. The engine ionises xenon atoms, then propels the craft by electrically accelerating the ions out and into space.



SPACE VEGETABLES

What we'll need to grow and how to grow it.

Keeping a team of astronauts fed for a three-year trip won't be easy. According to Doug Ming, a planetary scientist at NASA's Mars Science Laboratory, one solution NASA is researching is growing plants in transit and on the surface of Mars. They've already developed a full list of 23 crops that, along with being hearty enough (with some tweaks) for the Martian environment, will create a nutritionally balanced vegetarian diet for the astronauts. On the menu: carrots, mushrooms, onions, peas, peanuts, soybeans, sweet potatoes, and more. Even strawberries. Space crops will work double duty, providing food for the crew and regenerating oxygen through photosynthesis in artificial Earth environments. Some may be genetically modi-



Lettuce grows in a reduced-pressure atmosphere.

fied for the cramped conditions of space life. (Wheat, for example, can be manipulated to grow shorter than its typical 1,2 metres.) And since Mars has very little growing space, lacks any real water in its soil, and is thus inhospitable to vegetation,

all space plants will probably be grown hydroponically. Eventually scientists hope to be able to plant crops directly in Mars' soil. All they'll need is fertiliser. Luckily, the astronauts will be bringing that with them. Urine is naturally full of nitrogen, which

Martian soil is short on, phosphorus, and potassium – all great fertilisers. Instead of watering the plants directly, astronauts will more likely filter out essential nutrients and turn the rest into usable water.



THE TROUBLE WITH LIVING THERE

If the trip doesn't kill you, one of these issues just might.

DAY LENGTH

Days on Mars are 40 minutes longer than they are on Earth, which doesn't sound like a big deal, but Mars colonists will get out of sync with the circadian rhythms that govern things like sleep, hormone release and body temperature very quickly. Expect a lot of light therapy.

RADIATION

In space astronauts receive about 20 times the radiation we do on Earth. Along with increased cancer risk, radiation can also have unknown effects on the heart, brain, bones, muscles, and other organs. (Scott Kelly's year in space will provide illuminating data in all of these categories.)

One of NASA's nightmares is that increased radiation levels will cause a loss of cognitive abilities. At the moment the best protection is to get astronauts to and from Mars as quickly as possible. Once they're there the planet's atmosphere will shield them, since they won't be hit from all sides, like in the shuttle. Shelters will shield them even more.

NASA limits astronauts' radiation exposure to no more than would increase their cancer risk

by 3 per cent. Travellers to Mars will likely be exposed to more than that, receiving a lifetime dose during their three-year mission. When they get back to Earth, they won't be allowed to return to space.

ILLNESS

Any trip to Mars will be closely monitored by NASA's Office of Planetary Protection to make sure that life from one planet doesn't infect the other. Protection starts with sterilising spaceships' outer surfaces of microscopic Earth life. It also means disposing of human waste responsibly, often by storing it until the ship exits Mars' atmosphere, when it can be jettisoned into space.

The OPP also hopes to protect the astronauts from returning with the Martian version of the cold or chicken pox. The ships will be sterilised upon re-



Developing a protocol is essential before astronauts leave for Mars so that decisions aren't made in a crisis situation.

entry, and astronauts will be tested en route. If they are sick, good luck to them. NASA currently has no plan in place for dealing with space sickness. Developing a protocol is essential before astronauts leave for Mars so that decisions aren't made in a crisis situation. Otherwise, law often replicates maritime law, which states that any plagued ship must be sent back to the last destination it visited. Which means the closest thing to a hospital any sick astronaut sees would be staffed by Martian nurses.



WHY ARE WE EVEN DOING THIS?

The cacophony of voices excited about Mars can be overwhelming, so we assembled the words of the most vocal proponents into one moderately coherent argument.



1
Stephen
Hawking,
6/1/12



2
James
Cameron,
26/10/09



3
Elon Musk,
9/3/13



4
Ray Bradbury,
May 1996



5
Cameron,
26/10/09



23
Dennis Tito,
Inspiration
Mars Foundation,
27/2/13



22
Bradbury, May 1996



21
Obama, 15/4/10



20 Mars One Mission
Statement



19
Sonia Van Meter,
Mars One Finalist
20/2/15



18
Will.i.am., 29/8/12



17
Sally Ride,
2/2/03



16
Aldrin,
24/10/09



15
George
W Bush,
14/1/04



Mars One Mission
Statement
14



13
Carl Sagan,
May 1993



6
NASA, Journey to
Mars Overview



7
Bill Nye, 2/4/15



8
Barack Obama,
15/4/10



9
Buzz Aldrin, 24/10/09



10
Obama, 15/4/10



11
John McCain, 12/7/15



12
Obama, 15/4/10

"It is essential that we colonise space."¹

"We've become cowards... As a society, we're just fat and happy and comfortable and we've lost the edge."²

"The Sun is gradually expanding. In five hundred thousand million years - a billion at the outside - the oceans will boil and there will be no meaningful life on Earth. Maybe some very high-temperature bacteria, but nothing that can build rockets."³

"It's a religious endeavour to be immortal. If the Earth dies, we must be able to continue. Space travel will give us other planets to live on so we can continue to have children."⁴

"Mars is one of your better planets, because you could actually land there, and it's close enough to get to, and it's close enough to the Sun that it's not a big ball of ice."⁵

"Mars is a rich destination for scientific discovery and robotic and human exploration as we expand our presence into the solar system. Its formation and evolution are comparable to Earth's, helping us learn more about our own planet's history and future. Mars had conditions suitable for life in its past. Future exploration could uncover evidence of life, answering one of the fundamental mysteries of the cosmos: Does life exist beyond Earth?"⁶

"Space exploration brings out the best in us."⁷

"Now, I understand that some believe that we should attempt a return to the surface of the Moon first, as previously planned. But I just have to say pretty bluntly here: We've been there before."⁸

"We won the Moon race; now it's time for us to live and work on Mars, first on its moons and then on its surface."⁹

"Buzz has been there."¹⁰

"It's not going to capture the imagination in the same way."¹¹

"There's a lot more of space to explore, and a lot more to learn when we do."¹²

"The inspirational value for young people and others - education, technological spin-off, national pride, co-operation with other nations, and the building of bonds between industrial nations - all of that put together seem to me would be worth it."¹³

"As with the Apollo Moon landings, a human mission to Mars will inspire generations to believe that all things are possible, anything can be achieved."¹⁴

"We'll make many technological breakthroughs... and our efforts will be repaid many times over. We may discover resources on... Mars that will boggle the imagination, that will test our limits to dream. The fascination generated by further exploration will inspire our young people to study maths and science and engineering, and create a new generation of innovators and pioneers."¹⁵

"We may gain key insights into the past and future of our own world. The promise awaits for bringing back to life portions of the Red Planet through the application of Earth science to its similar chemistry, possibly reawakening its life-bearing potential."¹⁶

"There's something magical about pushing back the frontiers of knowledge."¹⁷

"This is about inspiring young people to lead a life without limits placed on their potential and to pursue collaboration between humanity and technology."¹⁸

"Space exploration is worth a human life."¹⁹

"Human settlement of Mars is the next giant leap for humankind."²⁰

"That's how we will ensure that our leadership in space is even stronger in this new century than it was in the last."²¹

"It's that simple, that great, and that exciting."²²

"Now is the time!"²³

PM



■ A PEDESTRIAN life |||||

The Ecomobility World Festival in Sandton is teaching the city of Johannesburg that you don't need a car to make it in the big smoke. BY LINDSEY SCHUTTERS

I ARRIVED AT O.R. TAMBO WITH nothing but the clothes on my back (neatly packed in a backpack) and the idea in my mind to survive 72 hours in Johannesburg at the mercy of public transport. It's the week before Sandton hosts the Ecomobility World Festival and I'm here to prove that Joburg was ready before the hype, and that the festival will only help to make an already world-class transport system even better.

The air-conditioned BMW is a welcome escape from the 30-degree streets. After an Uber ride and a short walk, I'm on an infrastructure tour around Sandton to see how far the festival preparations are. "This is the richest square mile in Africa and these people travel abroad without taking their cars with them, but when they get back home they're reaching for their car keys." Johannesburg Road Agency operations manager Sipho Nhlapo makes a good point about how Sandton residents – and South Africans in general – view public transport, never mind

the concept of ecomobility. To be fair, the streets of Sandton were due for a more pedestrian-friendly overhaul if the business district is to keep pace with the likes of Steyn City and the futuristic Chinese-backed Modderfontein City.

Although Nhlapo admits that retrofitting a city for alternative means of transport will never look as slick as a shiny new eco-friendly development, he is insistent on the motive behind the project. "We've maintained the inequality of the country in our road provision. In terms of the discourse around transport and movement, it has been a vehicle privilege," he explains. "All this road space is for one person in his car. We're trying to say it's unfair and we need to equalise things by making it safer for both pedestrians and cyclists."

The numbers behind this anti-car sentiment are quite staggering. Every day there are 3,5 million trips generated across the city of Johannesburg. These trips include work commutes, school runs, grocery shopping, pretty much

Agency Mpho Kau. "The city already has a metro bus service that covers quite a number of areas within the city, complemented by the BRT service and if you have a freeway system that also prioritises public transport, it just makes it more effective. That's where we're going in terms of infrastructure on our side." The mandate to make roads more inclusive is clear, even at freeway level with the M1, M2 and Soweto Highway earmarked for upgrades that include space for public transport.

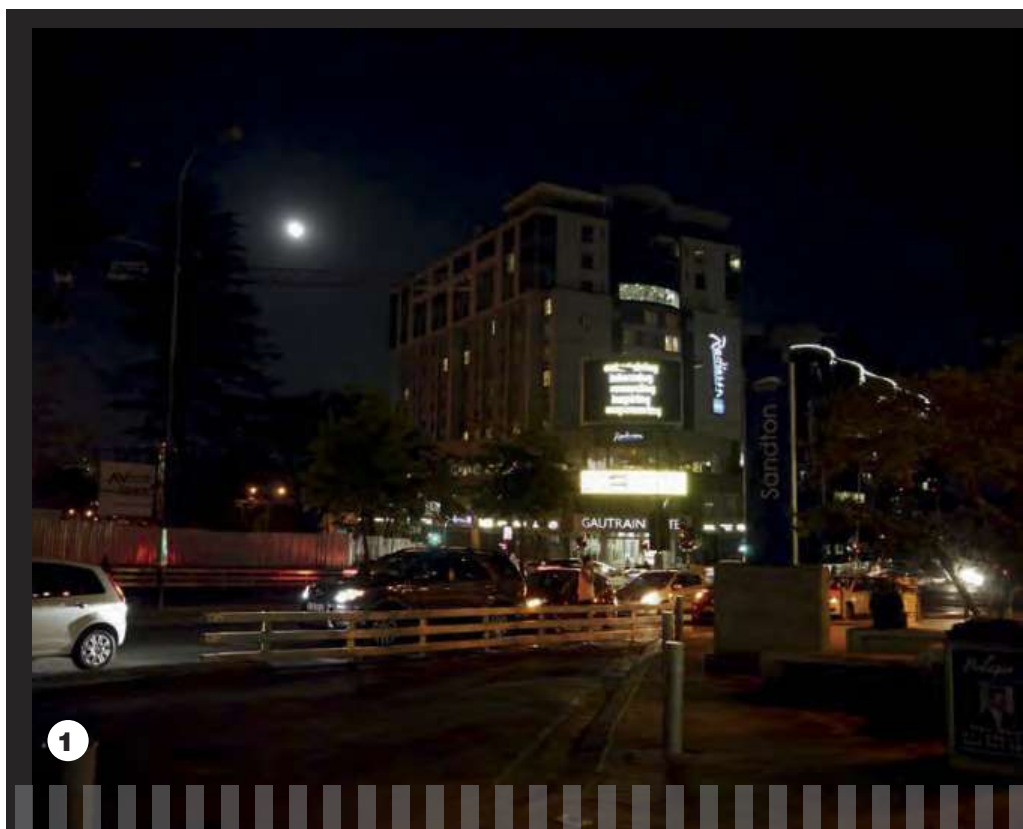
"In the townships or in the residential areas and built-up areas we're trying to promote cycling, walking, jogging and so on," Kau continues. "In the past when we were upgrading roads we used to focus only on the roadway; now our approach has changed in line with the complete



street policy that has been approved by the city. All our roads now include cycle lanes, sidewalks and, particularly in residential areas, we're implementing traffic calming measures. In most of the townships where we've upgraded gravel roads to tarred roads, the next problem we're called in to deal with is speeding. A number of calming measures are included in the (complete street) policy, like raised pedestrian crossings and constricting chicanes. These force motorists to slow down and creates an environment that's conducive to pedestrians because people will feel more safe."

While it's not the city's intention to vilify cars, motorists don't seem welcome in the Joburg of 2040. "Look at the construction that's happening here (Sandton). It's massive with some of these (new) buildings taking up 80 000 square metre footprints," explains Sipho Nhlapo. "The number of people who are going to be in these offices... You cannot have people using cars to come to this space because it's going to be gridlocked. You need to create an infrastructure that supports these kind of buildings and that should be public transport infrastructure."

The ultimate method behind the madness is to reduce the estimated average 40 minutes Johannesburg motorists spend in traffic, according to research company Numbeo's traffic index. TomTom's global traffic index doesn't paint a much prettier picture for the notoriously congested city road arteries: the GPS company's data suggests that you need to add about 54 per cent to your estimated travel time if you're driving in Joburg. So if you're taking what should be an hour commute, it will take you, on average, over an hour and a half. Although the numbers aren't as bad as choked-up Cape Town, a reduction in travel time in Jozi will go a long way in improving the national average



of 11 days (according to TomTom's index) South Africans spend in traffic per year. Ecomobility is exactly the intervention we need.

"There's no city in the world that can survive on private transport. In 2040, when you come into this city your choice of transport should be walking, cycling or public transport. In every part of Joburg you should be able to drive straight in with public transport, or, if you're fit enough you can walk or cycle," explains Nhlapo, echoing the acting MD's and the city's complete streets sentiment. "There are 10 000 people making their way from Alexandra to Sandton everyday and they are walking, so they're



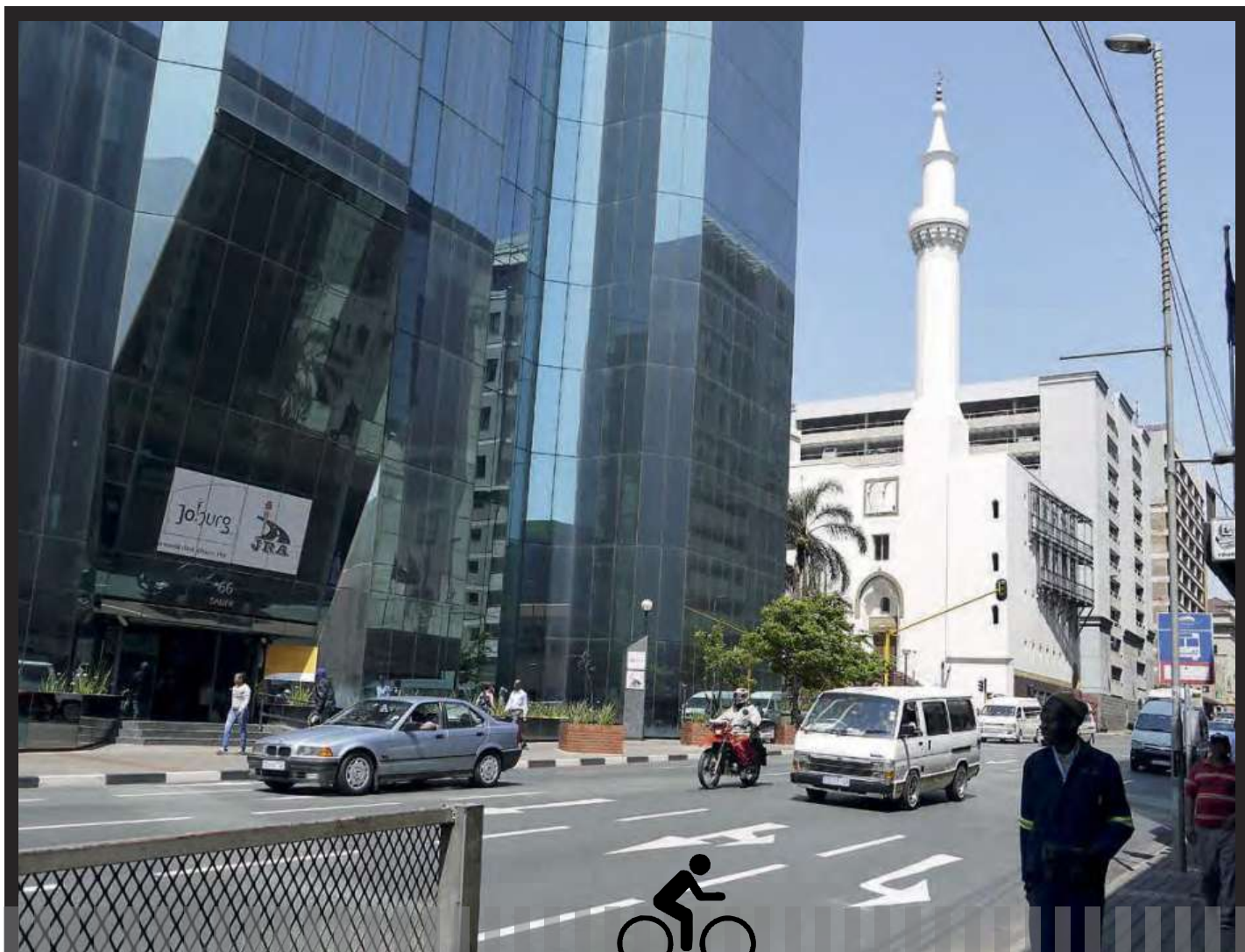
Clockwise from top left: (1, 2, 3, 6) Overnight, half of West street is reclaimed for pedestrians, alleviating the narrow problem that has plagued Gautrain users. (4) Protected walkways and dedicated bus lanes will make life difficult for motorists entering the central district. Bus routes won't however be accessible to cyclists, presumably for their own protection. (5) The revamped pedestrian and cycle route connecting the 10 000 daily commuters from Alexandra township to Sandton runs along the 5,2 km of Watt Street, Rautenbach Street and Grayston Drive. A footbridge is being constructed to stretch across the M1 highway to allow for an unimpeded journey.



already doing a good thing and we must encourage that. We need to make it look safe, exciting and something that is easy to do." Chief among the projects to assist these pedestrians is the Grayston foot bridge, an ambitious undertaking that seems like it will be completed well before the 2016 deadline. The bridge is supported by a newly completed cycle and foot path, lined with low energy light poles and stretching the full 5,2 km from Alex into the heart of Sandton.

The Sandton CBD is a hive of activity, with construction workers swarming to get all the pedestrian interventions done for the Ecomobility World Festival that aims to open

the streets of Sandton and the minds of its residents to alternative modes of transport. "The initial reaction was a bit of a shock, with a lot of people asking 'Why Sandton?'" says Elaine Jack, head of the Sandton Central Management District board, of the business owners' and residents' reaction to the festival. "But due to our close involvement with the city it's come to a reality that we do have to address the transport issues within the district and find some solution to decongest Sandton. Before the talk of the festival, we (the Sandton Central board) commissioned a Sandton transport study and presented it to the executive mayor (Parks Tau) as well as the Department of Transport,



Top: Headquarters for the City of Joburg's road transport overhaul rests at the Johannesburg Roads Agency building in the heart of the city. From here plans are laid and deals are made to keep the metropolis moving.

Above left: Lisa Seftal is the executive director for the City of Joburg Transport Department and manages the strategy behind the move to ecomobility and connecting the city.

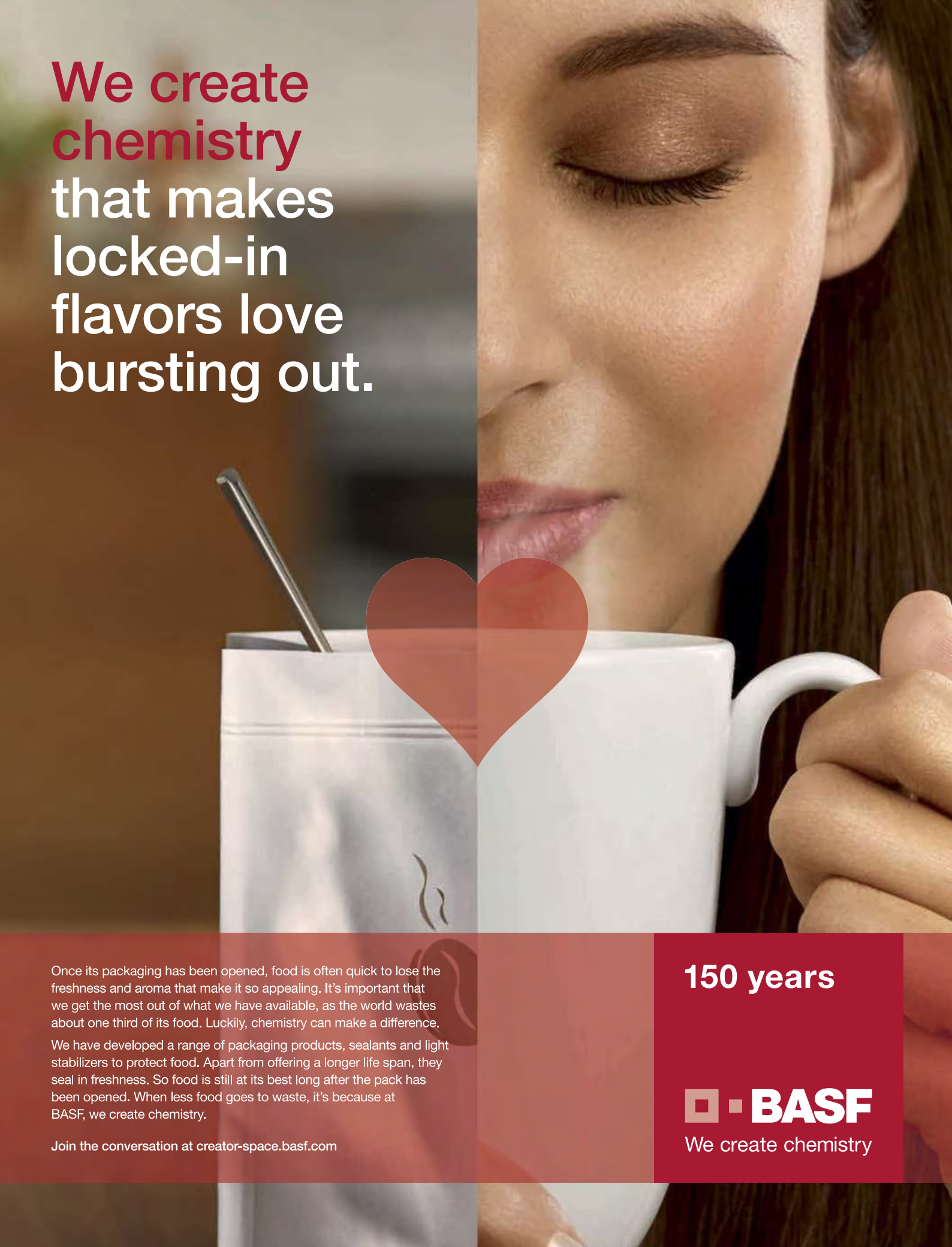
Above right: Johannesburg Roads Agency acting managing director Mpho Kau fills a seat vacated by his predecessor in April 2015.

and the suggestions that came out of that were to look at public transport and make that a spine into Sandton."

While this could be considered as a proactive move from the board, it was a bit reactive to the additional 400 000 square metres of new office space construction and the subsequent 130 000 commuters and their 9 000 cars that will add to the already maddening congestion before the end of the decade. Gautrain has played a huge part in alleviating congestion, with 16 000–17 000 commuters passing through the Sandton station gates daily, which accounts for just under 20 per cent of the current district-based workforce, but the service is almost running at full capacity.

This will really be pushed to the absolute limit during the festival, but the festival is also just a dress rehearsal for the construction that will start on 1 November. "There wasn't a bidding process because we were approached after the mayor showed interest," Nhlapo recalls. "We wanted to wait until 2017 to host and looked at Soweto as a possible venue, but the mayor asked us how having it in a poor neighbourhood would help the dialogue. He (Mayor Parks Tau) insisted that we have it in Sandton because it would open the dialogue with the key demographic that would need the most convincing to change their behaviours."

The Ecomobility World Festival is the convenient launch project for the City of Joburg's 2040 transport



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vision, and it's already been successful in starting a nationwide conversation about alternative transport. "As a city we need to be more compact and it is disproportionately more expensive to transport people from outlying areas like Orange Farm and Ennerdale. The city has an idea called 'corridors of freedom'," explains City of Joburg Transport Department executive director Lisa Seftel. "There are two kinds of these corridors. The one has continuous activity all along the route, like Lansdowne Road in Cape Town or Louis Botha Road in Johannesburg, and we want to concentrate development along those corridors with Rea Vaya and BRT transport along those routes. The other kind is an isolated freeway and, more importantly, rail, where you can bring people from the outskirts into the CBD with complete right of way. So if you're on the outskirts then rail is the most important node, which is why the Prasa revitalisation project is so vital."

"We want public transport, walking and cycling to be the mode of choice (by 2040). It's that someone chooses to do it and not that they're captive, because a lot of people now are public transport captives," she continues. Do you choose to sit in traffic everyday? Is there a comfortable alternative? These are all key questions that the city is trying to provide multiple solutions for which suit a wide array of personal needs.

The Gautrain bus ride from the JRA building to Park Station was shorter than I expected, but I had all my luggage with me and years of social conditioning had me worrying that I'd get robbed on the next corner. From there it's a 10-minute underground ride to Sandton, where I switched trains to head back to O.R. Tambo. I missed my family, but mostly I miss my fold-up bicycle because it would have negated at least two Uber trips. Johannesburg is ready for ecomobility. **PM**

JOBURG BY FOOT: THE NUMBERS

15 458 steps walked (10,9 km)

R263,93 spent across four Uber rides

8 389 Calories burnt

R314 spent on Gautrain

1 meal ordered in



create magical
moments^{this}

Christmas

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Changing the way the world **MOVES**

The quest: The next level in connectivity,
mobility and more

MONSOON SEASON IN MUMBAI. The deafening drumming of the rain is matched by the monotonous *swish-slap* of windscreen wipers. All that changes is the rhythm: fast, slow, intermittent. But that's good: with your wipers' every swish and slap, your car updates a data bank designed to ease wet-weather travel in this populous Indian city.

It's a concept that is just one example of the innovative thinking that has emerged from Smart Mobility, a global campaign being rolled out by Ford. The plan involves using innovation and concepts such as crowdsourced solutions to reach the next level in connectivity and mobility. The company says it began with 25 mobility experiments and developer challenges across the globe – with more launching throughout 2015 – to help change the way the world moves. (A London example is shown below.)

"If you can get enough cars that are connected, you can get really interesting real-time information," Ford's Global mobility solutions manager, Erica Klampfl, told delegates at the company's recent Go Further showcase of products and technology in Gauteng.

Of course, this is very much a global question. Congestion within the European Union costs around 100 billion Euros a year. Two out of every three Europeans live in urban areas. Not surprisingly, their commutes are a constant problem.

One of those congestion-busting technologies, on show at Go Further, was a delivery E-bike. "We think of a car as just one mode in a multi-mode system," Klampfl said, "like walking or hopping on the Tube". Or biking.

What makes this E-bike special is that it can be recharged from a Ford vehicle. "It started with an innovation challenge we had internally. That involved ideas around E-bikes and how they might integrate with cars."

This E-bike's reason for existence is congested urban environments. After driving a delivery van containing three folded e-bikes and their riders as far in as it is allowed to go, the bikers and their goods proceed onward to deliver.

YET URBAN AREAS ARE NOT THE ONLY AREA OF concern, even if 70 per cent of the world's population will end up living in the cities. "That leaves 30 per cent who have to deal with other issues," said panellist Professor John Forrer of George Washington University. Forrer is involved in a partnership between Ford and World Vision on a project called the X-Car. That project takes the mobility and connectivity in the car and travels to rural areas to deliver services to people who wouldn't otherwise have access to those services.

"And it has three particular components: it bundles the services together, it has to be self-financed and it has to be franchisable. What we mean with the bundling is the vehicle may be going out to a community to receive some health services, but we are working with Ford to see if they can put a refrigerator in the back. So it then becomes a cold line, so that vaccines can be taken out at the same time. And then while the vehicle is going out, it can be fitted with a solar panel, maybe a smaller one than we are familiar with. We have been looking at the areas of energy, water,

education, even banking." For each service added, costs go down. "The value to companies like Ford in this kind of partnership lies in the opportunity to innovate and find new markets," said Forrer.

"Cities are really interested in the data that we might collect," Klampfl said. "For example, they might have speed zones in certain areas for traffic or bike safety and we can provide them with heat maps of where their high-speed areas are, so we can potentially send more enforcement there."

Outside of cars, Ford engineers are working to develop sensor kits based on open-source software that gathers information from bicycles and other common forms of transportation in urban areas. The devices gather data such as wheel speed, acceleration and altitude and could provide insight into how alternate modes of transportation might be best positioned to serve future urban mobility needs.

"We have another bike project, Infocycle, that helps collect data about where cyclists are riding. That can help cities understand where they might need bike paths, where they might need to put lighting to support bikers. So there are lots of really great insights possible."

Panellists touched on the influence of services such as Uber on mobility patterns, with the possibility that motor companies would intensify their efforts towards connected cars, fleets and vehicles designed specifically for urban commuting. "The balance of fleet to individual sales might change," Klampfl said. "Also, fleet customers tend to turn over more frequently versus personal ownership. And it's not just that for every car-sharing car, there's one less car on the road. That car-sharing car gets more use."

Driverless cars, seen as one potential solution to congestion, have bureaucratic issues to deal with. Klampfl said that the technology was well developed: "We feel we can be there in five years, but that doesn't necessarily mean available to the consumer."

To help refine the concept of autonomous drive, manufacturers such as Ford are involved in consortiums, such as the Mobility Transformation Centre in Ann Arbor, Michigan. We are doing that with other OEMs. By all of us working together, we are going to push the issue forward. We also have the Department of Transportation in Michigan involved in that and the government is interested in being part of that journey."

– ANTHONY DOMAN **PM**



CARS



MAZDA MX-5 (MIATA)

HEY, LOOK, IT'S THE NEW MIATA!
AND IT FINALLY LOOKS AS GOOD
AS IT DRIVES.

BY EZRA DYER

This is a misunderstood car.

To purists and gearheads, it's the ultimate affordable sports car, a lightweight tub of fun, the rare track car that won't maul your wallet every time you need brake pads. Car people not only respect the Miata, they revere it. That view makes sense. But the rest of the world thinks that Miatas are a little bit goofy – if Hollywood wants to tell us that a character is clueless, it brings in the Miata. Remember the Chris Kattan bomb, Corky Romano? Corky drove a Miata. (Licence plate: corkstr.) Mazda got so bummed out about the Miata's image that it once tried to get everyone to stop saying Miata and just call the car MX-5. It didn't work...

So although Mazda finessed the new 2016 MX-5 with deeply impressive engineering – less weight, snappier engine response, the best manual convertible top ever designed – perhaps the most important thing it did was make it look meaner. This car is not cute or lovable or goofy in any way. With its creased fenders and sharply defined lights, the MX-5 reads as a shrunken Jaguar F-Type. This is a car that will

SPECS

WEIGHT:	1 057 kg
ENGINE:	2,0-litre four-cylinder
POWER:	115 kW
TORQUE:	200 N.m
TRANSMISSION:	Six-speed manual
BASE PRICE (IN USA):	R345 600



Clockwise, from left: MX-5's styling more aggressive than predecessors; taillights are very F-Type-ish; cabin laid out for maximum driving enjoyment.



attract buyers who aren't already part of the devoted fold, while at the same time appeasing loyalists by amplifying the simple pleasures of driving.

The MX-5 is the kind of machine that tempts you to detour an hour out of your way to hit the Tail of the Dragon, that diabolical scribble of pavement laced across the Tennessee-North Carolina border. Which is exactly what I did. With 318 curves in 18 kilometres, the Dragon never uncoils enough to let you build up much speed. Here, it's all about reflexes, a car's ability to flow from one apex to another on a road so kinked that your front and rear axles are sometimes dealing with different corners. This is MX-5 turf, a place that rewards nuance over brute strength.

Mazda squeezed about 68 kilograms out of the new car, no mean feat when the old one didn't weigh that much to begin with. You can examine almost any detail of the car and see where Mazda excised mass. Consider the seats: Mazda uses webbing, like in an Aeron chair, in lieu of weighty foam. It also ditched a height-adjustment mechanism by mounting the seats on angled rails, so the seat rises as you approach the wheel. It all works beautifully. "The whole car is built around the driving position," says MX-5 lead engineer Dave Coleman. "Driving enjoyment is the fundamental purpose of this car, so we moved things millimetre by millimetre, moving the driver towards the centre." There is certainly no wasted space. You can raise a knuckle off the steering wheel

and tap the windshield.

Running the Dragon from the Tennessee side means that you're mostly climbing uphill, a situation that the prior Miata would've tolerated rather than embraced. While this one is down on peak power – 115 kW versus the old car's 125 – the new 2.0-litre engine makes more power at anything less than 6 000 r/min. Which is where you're running most of the time. The car feels eager, energised. It's not a Honda S2000, but no longer is the engine just that thing up front that makes the car go so you can enjoy the chassis. The four-cylinder sings, and it's loud, and there's no overdrive gear in the six-speed manual transmission. You may as well take the Dragon rather than the highway.

And on the Dragon, you'll heel over in every corner, body roll being one way that the Miata imparts a sensation of speed. You'll hit the redline in first and second gear but hardly ever get too deep into third. The steering wheel tells you the texture of the road, and whether the driver's side tyres are on the marbled pavement in your lane or straying onto the smooth paint of the centreline. Mundane family cars and SUVs and plodding Harleys pull out of the way when they see the Mazda's hungry snarl in the rearview mirror.

Respect. It's what the Miata deserved all along.

FORD FOCUS ST3 ANTE UPPED

The Blue Oval is no stranger to the hot hatch segment. For dynamic handling and a punchy engine, look no further than the ST-badged models. But these models have been punching particularly hard above their weight when it comes to value for money.

Snug in the heavily bolstered and Recaro-branded driver's seat of the ST3, gripping the chunky rim of the multifunction steering wheel and beefy six-speed shift knob, I'm particularly appreciative of the neatened fascia. It now features an integrated 8-inch touchscreen, included as standard in the ST3 specification sheet, as is a revised SYNC 2 infotainment system. And audiophiles, pay attention: music can be played from an auxiliary input, an SD card slot, or from one of two USB ports through a nine-speaker Sony sound system. There are also two 12 V power points to keep personal devices charged.

Ford took it on themselves to kit the ST3 with just about every conceivable extra. That includes automatic and cornering bi-xenon HID headlamps, automatic windshield wipers, keyless entry and start, dual-zone climate control and leather upholstery.

The 2,0-litre Ecoboost engine fires up via push-button start and settles into a rather unassuming clatter. Prod the throttle for long enough to build boost, though, and the ST responds with an addictive



NEED TO KNOW

ENGINE:	2,0 four-cylinder turbopetrol
OUTPUT:	184 kW/360 N.m
ECONOMY (COMBINED):	6,8 litres/100 km
EMISSIONS:	159 g/km
PRICE:	R421 000

elasticity – particularly strong around the 3 000 r/min mark.

Driving the ST enthusiastically highlights another key area of improvement; ride dynamics. Ford increased the front-end structural stiffness by increasing the thickness of two brackets, while the suspension system gets new front springs and revised damper tuning, as well as stiffer bushes front and rear. Along with the tweaked Electronic Torque Vectoring Control system, these minor adjustments go a long way to making the ST feel a lot more athletic.

Though it does exhibit some axle tramp on fast getaways (yeah!), on the plus side understeer wasn't once brought up when speaking about the fast Ford's potential pitfalls. Speaking of which, if the ST is even more exciting to drive at speed on the perfect piece of asphalt, I think that's come at the expense of some of the daily driving comfort, as the suspension might now be too stiff for some. Still, for the money, the ST is a performer that's hard to beat. – KK

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VOLVO V60 XC D4

THE ROAD LESS TRAVELLED

There's a well-travelled sandy track that runs parallel to the coastline, in among the dunes between Paternoster and Stompneusbaai on the Cape's West Coast. For the most part, it's little more than a benign rollercoaster that needs no special abilities. (Exhibit 1: the ageing Ford Escort parked at the cottage about halfway along.) Still, in these conditions the V60 XC adds a layer of security with all-wheel drive and boosted ground clearance. And when the going got ugly, on one rutted, pitted and horrendously sandy slope, there was reason to be grateful for the traction aids quietly – and sometimes not so quietly – going about their business.

The Volvo is firstly a wagon with some off-road abilities, which is the way I prefer it. The XC stands 65 mm higher than the regular V60 and bolsters its off-road cred with mean-looking body armour, too. A high-speed kilometre-eater on the open road, a relaxing magic carpet ride in rush hour, the V60 XC can venture some way off the beaten track without hesitation. Besides the AWD, there's also torque vectoring and corner traction control. On really rough surfaces I would question the wisdom of the low-profile tyres on 19-inch wheels fitted to our car, though.

On any surface, the D4's combination of refined automatic 'box and smooth torquey five-cylinder turbo provides formidable overtaking urge. Observed fuel consumption averaged 8 litres/100 km over the course of a weekend. – AD

NEED TO KNOW

ENGINE	2,4 five-cylinder turbodiesel
OUTPUT	190 kW/420 N.m
ECONOMY (combined)	5,7
PRICE	from R499 900



AUDI Q7 3,0 TDI

BEAUTIFUL BRUTE

The words "Home of quattro" sat proud on a red Audi banner that was very conspicuous in the bushveld of the Dinokeng Game Reserve. Well, maybe not as conspicuous as the convoy of new Q7s that made their way through the region. But it wasn't as if Audi's range-topping SUV didn't feel at home – quite the opposite in fact.

The corrugated roads and sandy paths offered very little resistance to the Teutonic titan, and it was just the occasional sighting of local fauna that halted our progress. Only one derivative was available for the ride and drive of the local launch and is the sole model available for now, the 3,0 TDI Quattro Tiptronic. Its turbodiesel V6 engine is good for 183 kW and 600 N.m of torque and through its quattro drivetrain and eight-speed automatic transmission easily ploughed through the softer surfaces of the launch route – never mind that it wore the optional 20-inch alloys.

The second-generation Q7 marks a huge departure in terms of styling from its ancestor. Gone is the rounded styling, making way for an angular design theme that uses Audi's massive single-frame grille to great effect and bold character lines along the profile. Audi claims that this is the largest interior in the segment.

As usual, Audi's done an excellent job with the cabin. Certain elements of the Q7's interior design really stand out, such as the prominent climate control vents that span

the width of the fascia, aircraft-like gear lever, and large infotainment screens forming part of the MMI Navigation Plus system and Audi's Virtual Cockpit (8,3 and 12,3 inches respectively) that doubles as an instrument panel.

On the road, the Q7 is incredibly refined, with the optional adaptive air suspension in the launch models soaking up serious imperfections in the blacktop. What really impressed me was just how light the Ingolstadt SUV felt on its feet. That must be at least partly thanks to the massive weight reduction of up to 325 kg from its predecessor.

An interesting option that we didn't get to sample is the new four-wheel steering system, which should prove to be handy in tight spaces. One option I didn't miss: the mid-level Bose 19-speaker audio system provided ample aural delight, so you wouldn't find me ticking the high-end Bang and Olufsen unit. KK



NEED TO KNOW

ENGINE:	3,0 five-cylinder turbodiesel
OUTPUT:	183 kW/600 N.m
ECONOMY (combined):	5,7 litres/100 km
EMISSIONS:	149 g/km
PRICE:	R924 000



apollo

GO THE ————— DISTANCE



FRANKFURT MOTOR SHOW

UNDER BRIGHT LIGHTS

OUR PICK OF THE BUNCH AT THE 2015 EDITION OF THE IAA.
BY KYLE KOCK



ALFA ROMEO GIULIA

We'll come right out with it: the only Giulia we're really interested in is the range-topping Quadrifoglio (the one that wears the cloverleaf badge). It's equipped with a 2,9-litre twin-turbo-charged V6 engine that produces in the region of 380 kW and 600 N.m of torque. Alfa Romeo is claiming a sub-four second zero to 100 km/h sprint with a top whack in excess of 300 km/h. The Giulia's already managed a seriously impressive 7 minutes 39 seconds around the notorious Nürburgring Nordschleife. Watch your backs, BMW M3 and Mercedes-AMG drivers...



INFINITI Q30

The premium Japanese brand enters the compact hatchback segment with the Q30, which will take the fight to the likes of Audi's A3, BMW's 1 Series and the Mercedes-Benz A-Class. It's certainly got the styling down, with a dynamic profile that's emphasised by a long bonnet, narrow glass, swoopy character lines and that familiar kink in the C-pillar.



AUDI A4

Predictably, Audi's opted for an evolutionary styling update on its new A4. But more importantly, the best features lie underneath the sheet metal. Despite being larger than ever, the A4 is now 119 kg lighter than before and comes with a healthy dose of technologically advanced features. Those features include Audi's Virtual Cockpit – a 12,3-inch instrument panel that debuted on the TT – and optional Matrix LED headlamps.

JAGUAR F-PACE

The F-Pace promises to be a dynamic success, on and off the beaten track, by way of its supercharged V6 engines (available in 253 kW and 283 kW guise), double-wishbone front and integral-link rear suspension, Adaptive Surface Response, low traction launch and short front and rear overhangs. A shockproof and waterproof wristband will substitute the key fob when the driver goes exploring.



MERCEDES-BENZ S-CLASS CABRIOLET

The Three-Pointed Star is steadily increasing the S-Class model line-up, with the latest version being the drop-top you see here. As can be expected, the S-Class Cabriolet packs the very latest comfort features that'll eventually make it down the rest of model range over the next decade. The list includes heated rear seats, heated armrests, an improved version of the neck-heating Air Scarf system, and even speakers on the rear deck (where the fabric roof is stored) by audio specialists Burmeister.



OPEL ASTRA

The Astra goes from strength to strength as General Motors refocuses on the German brand. The fifth Astra, if you don't follow the old Kadett naming convention, is up to 200 kg lighter than its predecessor, thanks to the use of lightweight materials in its bodyshell, platform and front and rear axle. It also offers strong specification for the segment it competes in, such as matrix LED headlamps and compatibility with Apple CarPlay and Android Auto. The engines on offer range from a 1,0-litre three-cylinder turbopetrol to a 1,6-litre four-cylinder turbodiesel.



VOLKSWAGEN GTI CLUBSPORT

The quintessential hot hatch gets another shot in the arm as Volkswagen celebrates the 40th anniversary of the GTI badge. Just what can we expect? Well, the GTI's relatively subtle exterior has seen some welcome aggression in the form of restyled bumpers, model-specific alloy wheels and Clubsport decals along the profile, as well as large-diameter dual tailpipes and roof-mounted wing. All that show is matched by 200 kW of go – a healthy 37 kW increase from the standard GTI. VW claims that a Clubsport equipped with the optional DSG transmission will scoot to 100 km/h in 5,9 seconds.



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HONDA PROJECT 2&4

The illegitimate love child of a car and motorcycle, the Project 2&4 is a tantalising one-off that's very likely not to make production. But who wouldn't want to experience a screaming i-VTEC engine, all the wind protection of a motorcycle and the comfortable seating position of a car?



MERCEDES IAA

The retro-futuristic IAA boasts a wind-cheating drag coefficient of just 0,19 thanks to an extendable rear end that obviously not only increases performance, but also drastically improves fuel efficiency and lowers CO₂ emissions.



PORSCHE MISSION E

Having wowed the automotive industry with its 918 hybrid hypercar, and winning the 24 Hours of Le Mans at only the second attempt with the 919 hybrid racecar, Porsche's Mission E is a convincing (and very exciting) vision of what electric motoring could very well turn out to be.



BUGATTI VISION GRAN TURISMO

The French firm already achieved the pinnacle of modern motoring with the Veyron and is hard at work on a successor. But given the limitless parameters of the virtual world, the Bugatti VGT is another world-beater. Could this be the new Veyron?

PM

■ Part 9 of our series Motorsport Technology Down the Ages

Driving the future

Who's the real hero: the driver or the car?

Into the seventh decade of Grand Prix

racing, we still picture the champion driver heroically calling on every scrap of individual mastery to wrestle a high-speed snarling projectile to the chequered flag. Occasionally, though, the TV cameras flash to where the real action is happening. The management team, gazing at video monitors, analysing the constant telemetry stream that tells them what their car is doing, is a reflection of the fundamental changes that have occurred in our everyday lives: the impact of computers and electronics. Without that technology, much of today's racing wouldn't be possible. And the driver would be... well, stranded.

Probably most importantly among the electronics involved in top-level racing is the car's computerised control systems. Instead of having just a combustion process to manage, today's systems need to cope with an unimaginably complex undertaking. For one thing, current grand prix cars use hybrid power units, not engines. They're a combination of internal combustion motors (1,6-litre V6, developing around

formidable number-crunching power.

But smart cars aren't new to racing.

The revolution began in the 1990s with the likes of Lotus's active suspension. It wasn't long before developments in other areas took hold: anti-lock braking, traction control, computerised "launch controls" and automatic gearboxes

It couldn't last. When the technology gave some competitors a clear advantage, the response from the rulemakers was predictable – they banned it. Perhaps the ultimate expression of this was Nigel Mansell's Williams FW14, which took him to a world championship by utterly demolishing the rest of the field. Manufacturers kept trying to sneak some of those technologies back under another guise, but each time the authorities slammed shut the loopholes in the rules. Those efforts culminated in a generic control unit being mandated for all cars.

COMBING THROUGH TERABYTES

From the initial stages of creating a car, as is done with everything else built on an industrial scale, computer-aided design tools are the norm. Once the car is actually on the track, IT-based performance-analysis tools are de rigueur as teams comb through terabytes of information in the hopes of unlocking a few thousandths of a second here and there.

In recent times, stress analysis and computational fluid dynamics have come into their own at the design and testing stage. In CFD, computer-generated models of the car help analyse simulated airflow behaviour. Some have even gone as far as using CFD instead of, rather than in addition to, conventional wind-tunnel testing. The use of CFD – faster, cheaper, more flexible – has become so widespread that the rulemakers had to clamp down on even that by limiting the extent to which it can be used.

Mobile data centres, computer clusters and high-speed communications networks are all part of the racing team's technological armoury. At the track, banks of workstations reflect information from on-board sensors – thousands of them – monitoring everything from engine revs to g forces. That information is analysed and compared with current and historical information to optimise the car's performance.

In the past few years, the emphasis has been on sustainability and safety. That's given rise to redoubled efforts to cut speeds, improve efficiency and rein in costs. Costs, particularly, have been assuming increasing relevance as the sport looks to ensure its survival. Still, looking back over nearly seven decades, the question remains: hasn't it always been this way? ●

Computers are responsible for almost everything but actually driving the car. And they seem to do much of that, anyway...

450 kW under current regulations) and energy recovery systems. The intention: to be more environment friendly by harvesting energy from braking and exhaust gases. The "free" energy recuperated is stored until needed, when it boosts total output significantly enough (more than 100 kW) to provide a boost that allows overtaking when needed – or optimises output for the most efficient, most economical operation. Managing all of those separate subsystems clearly requires



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A “most violent hobby”

Clanking armour and ferocious swordplay meet good old South African ingenuity



The ringing clash of metal on metal comes as a shattering jolt to the senses.

And that's just to the onlookers. Even from inside a protective cocoon of a 20 kg stainless steel suit of armour, the bludgeoning impact of a broadsword sets the head ringing and the nerves jangling.

Welcome to Orusta.

Named after the Runic word for battle, Orusta is a fast-growing martial arts discipline that brings back days of old, when knights were bold. And brutal.

Full contact medieval combat is so rough and tough that it has been called the world's most violent hobby. It could also qualify as one of the world's most exhausting hobbies, even if each of the two or three rounds lasts only 60 seconds.

Despite the “violent hobby” tag, medieval swordfighting is growing worldwide. Although only starting to take hold in scattered pockets around South Africa, thousands are involved in other parts of the world. It's particularly popular in Eastern Europe, the United Kingdom and the United States. The first world championships were held four years ago and, earlier this year, a South

Armourers and sword makers are sprinkled around the country, catering to the specific needs of this sport.

To engage in medieval combat, you don't just strap on a crash helmet, grab a dustbin lid, wave a length of angle iron and bellow, “Have at thee, knave!” Besides running the real risk of having someone cleave your brisket in twain (this is a technical term), you'd be shunned by true enthusiasts. For when it comes to the medieval combat business, authenticity is everything. That holds true for both the equipment and the way it is used. The head, neck, torso, arms, legs and hands must be protected by steel. All must be analogous to historic originals, which means dating back to the 13th and 14th centuries. And you can't buy this stuff off the shelf, either. Generally the armour is “bespoke”, to fit a certain physique.

To ensure conformity, national and international controlling bodies have codified medieval combat. The IMCF has produced a book of rules that runs to 20 A4 pages. The detail runs to such minutiae as the thickness of the metal used. In the case of helms (what we call a helmet is actually the diminutive), that means 2 millimetres minimum thickness for stainless steel, 1,8 millimetres for hardened steel and 2,5 millimetres for mild steel. Face plates can be made of any of these metals, but must be at least 1,5 millimetres thick. However, there are no rules for the rudimentary padding used on helms.

Similar dimensions are used for the metal employed in the rest of the armour. The emphasis is on authenticity to “documented historical analogues”.

Secondary armour, worn under



BY ROGER HOUGHTON

African team fared well in the International Medieval Combat Federation (IMCF) championships in Malbork, Poland.

Currently there are 30 active full contact medieval sword fighters in South Africa and a similar number in training. The local input into these scenes of medieval mayhem on South African soil isn't restricted to the participants, though: most of the armour and swords used in South Africa are made right here.

Left: Combatants ready for action. Top: Anton Moller shows a helmet “under construction”. It is made in three basic parts and then welded together. Above: Fighting at the Magical Medieval Fayre.



the steel, is known as an aketon or gambeson. It is padded and must again be aesthetically correct. The armour plates are attached to the secondary armour to provide protection in critical areas.

Fighters in the 21st century are permitted a third layer of protection next to the skin. But this must be hidden from sight so as not to detract from the medieval appearance of the combatant. In this category are modern groin protectors and knee braces.

The dimensions in terms of weapon edge roundings, lengths and weight are specified for each individual type. And there are plenty to choose from: single-handed swords, longswords, two-handed swords, axes (single- and double-bladed), maces and polearms. (A polearm is a two-handed weapon, usually in the form of a wooden pole slightly longer than the height of its bearer, fitted with an axe-like head.) All are subject to weight restrictions.

Shields are made of wood, wicker, leather or metal. They can be used only with a set of armour from the same epoch and region and cannot weigh more than 5 kg.

Outside of scheduled championship events, enthusiasts have several opportunities to display their skills in public. One of the best is the Neigh-Bours Magical Medieval Fayre, which is held opposite the Lion Park in Sandton, Gauteng, once a year. When this event was staged for the third time recently it was amazing to see how many people joined in the fun wearing period costumes. Dogs obviously played a big role in medieval life and there were many being exercised on leads – including huge wolfhounds.

At the same time, besides sword-play other kinds of martial arts from bygone eras were on the go. One activity for riders involves shooting at targets with a bow and arrow from a cantering horse. Another group on horseback used razor-sharp swords to slash the green leafy tops off pineapples while galloping past. The success rate of the participants was impressive.

Full contact medieval combat competition is organised according



to the number of combatants. It starts with one-on-one duels and then there are contests for three, five, 10 and ultimately 16 people in each team. There is a string of dos and don'ts for each form of fighting, but basically strikes behind the neck, back of the knees, ankles, groin and throat are not permitted. Clearly, however, there's still plenty left to take aim at.

Duels between two individuals are scored with points awarded for strikes, disarms and making your opponent fall to the ground. Team competitions are scored on the basis of the number of people from each team standing at the end of each round. It's like being on a real battlefield, hopefully minus the gore. No prizes for guessing that the team competitions are a spectator favourite. In Scandinavia and Eastern Europe the following is akin to what cage-fighting enjoys. Locally, our limited numbers don't allow serious team competition – yet.

Although South Africa may lack the numbers, we definitely have an advantage in one area: local suppliers of armour and weaponry have made expensive imports all but unnecessary. Anton Moller, a member of the Orusta club in Randburg, is a typical enthusiast who has taught himself this black art. He is now an accepted supplier of equipment that is up to international standards. That much was obvious when the national team went to the championships in Poland earlier this year.

Although today's swordsmiths and armourers use many traditional



Top left: One-on-one fighting at the Magical Medieval Fayre. Top right: An impressive gambeson made of leather panels. Above: This is the type of clamshell hand guard that Anton Moller now favours after having his finger broken when he wore a glove with separate armour for each finger.

methods in their craft, they do have one priceless modern advantage: the World Wide Web. Need historically correct armour and weaponry and instructions on how to make it? Simple, download it.

Actually, Moller says, it's not quite that straightforward. It's only through painstaking experimentation that he has managed, he says, to reach the standards he sets for himself in terms of the products he is making. Judging by what are really works of art that he has pro-



Left: Sam Spiers, clad in a hand-made chain mail shirt, with a display of helmets at the Magical Medieval Fayre. Below left: Elimore Zulu at work peening a piece of stainless steel, which will form part of a suit of armour. Below right: Moller takes a red hot sword blank from the charcoal forge to quench it in the oil in the brown pipe.



duced, it's hard to believe that he has been learning this new craft for only the past two years.

He has already made three sets of armour for himself and is now working on a fourth. Each one is better than the last.

It can take two to three weeks of full-time work to make one set of armour. The handmade suit sells for about R15 000, plus R5 000 for sec-

ondary armour. (If you think that's expensive, try mountain biking.)

Moller's swordsmith journey started five years ago with a knife-making course. He then adapted his newly acquired skills in working with and hardening steel to what he thought would be more rewarding: swords. That led inevitably to a mediaeval combat group. It all isn't a surprise, really, considering this inveterate thrill-seeker lists moto-

cross martial arts in his pedigree.

As Moller's day job is tree surgeon, he has been fortunate to find a very able assistant, Elimore Zulu, to help him in the time-consuming tasks involved in making a suit of armour. Zulu, a tree-feller, showed aptitude for working with his hands.

The factory is a crowded workshop on Moller's plot. Most of the armour is made from stainless steel, which work hardens as it is shaped and peened. The pieces are cut from patterns traced on stainless steel sheet of varying thicknesses, using a small cutting disc on an angle grinder.

The manufacturing operation is very basic and generally starts with making the first shape using a ball peen hammer and a depression in an old tree stump. The shaping continues on a large ball bearing (about 50 mm in diameter) welded on top of a piece of steel reinforcing rod or on an anvil. The metal is beaten into the required shape with an assortment of hammers and then a grinding wheel is used to ensure it is accurate to the pattern.

Making helmets is a big challenge. These are typically made from three pieces that are shaped and then welded together: two halves for the main part of the helm and then a neck piece. Moller only has an arc welder, but once he has finished off the helm on a grindstone and polished it the appearance is very good.

Making the intricate face plates is particularly time-consuming. The individualistic look of these is partly responsible for the wide variety of helmets, which have become like signatures for the combatants. The designs were adapted over the years to cope with the changes in prevailing weaponry faced in mediaeval warfare.

Making hand protection can be finicky work. Leather welding gloves usually form the basis and the armour can take the form of individual protection for each finger or a clamshell-like protector. Moller favours the clamshell after a broken finger cost him a place in the South African team to Poland...

In the continual striving for historical accuracy, Zulu even makes the buckles for the leather straps by bending wire to shape. Moller cuts straps from a piece of hide and then stains them with vegetable dye – yet another authentic touch. His padded jackets are more typical of the modern era, though: he makes these from bull denim, using his wife's sewing machine!

Shields start as two layers of plywood. Moller dry bends the wood and glues reinforcing around the edges before covering the front of the shield with fabric.

Making swords is another job altogether. This starts with tracing a pattern on spring steel and then grinding



Far left: A sword blank lies on the anvil with the LPG forge in the top left corner.

Left: Choose your weapon... plenty to choose from!

Middle: The high quality of the finished locally made sword is very evident.

Bottom left: Moller displays his gambeson secondary armour with primary armour plates attached to critical areas.

Below: Ready for action.

it to shape. Next follows the critical task of hardening the blade.

Moller has the option of LPG or charcoal forges when the time comes to harden items. For forging long blades, he prefers the charcoal and then dunks the glowing metal in a tube of quenching oil to complete the hardening process.

He is also experimenting with making blades from Damascus pattern-welded steel. This involves hammering together a layer of steel and a layer of iron while they are at a very high temperature. In the old days, this was a costly method of making a sword blade, but the final product was of a superior quality.

All of this is pretty amazing when you consider that it all started with signing up for a course with the intention of crafting a braaivleis or biltong knife...

To get involved in medieval combat, you will need to seek out one of the several clubs, guilds and the like that exist in South Africa – even in out-of-the-way places such as Plettenberg Bay. Beginners start off using foam padded shields, foam plastic “swords” and fencing head guards before progressing to controlled combat using the real, metal, gear. Combatants must be at least 16 years old to participate in full contact combat with proper weapons.

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Find out more: Anton Moller (Badger Armoury) arbor@gmail.com 083 600 9786

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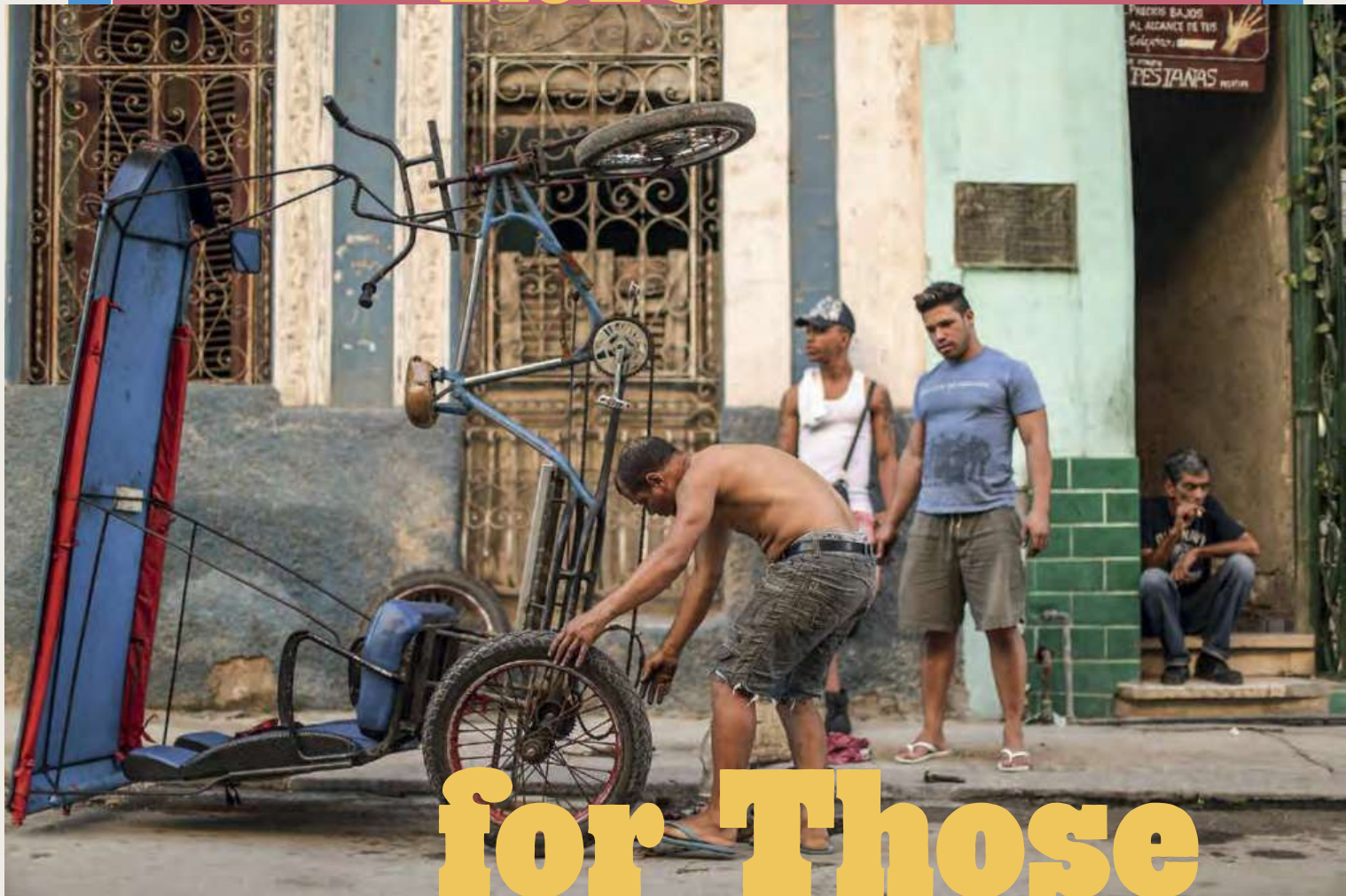
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REPORT: CUBA

"Nothing Is Impossible"

POPULAR MECHANICS goes to Cuba and finds a people devoted to hard work and ingenuity – often by necessity.

BY KEVIN DUPZYK



for Those Who Fight "

ON OUR SECOND DAY IN CUBA, we saw in one humdrum, ten-minute transaction a clue to the way life is lived in a country where daily life is often a challenge.

We had hired a man called Francel to drive us from Trinidad, a five-hundred-year-old town on Cuba's south shore, to Varadero, a resort town three-and-a-half hours northwest. Francel was tall and thin and wore black, just like his car, a mid-1990s Peugeot. At twenty years old, it looked boxy and dated, but it was newer and in better shape than most cars in the country – it's not like everyone in Cuba drives a well-preserved American classic, the way you hear about. The Peugeot's floor mats were red plastic with a diamond-plate pattern. The air conditioning worked and so did the seat belts, both noteworthy. Every window was tinted dark with the exception of small cutouts so Francel could see the side-view mirrors. Inexplicably, the cutouts were the shape of the Apple logo.

Just outside Trinidad, Francel pulled off the road into the side yard of a small house. A man with no shirt on sat on a chair out front, just sitting. Francel drove around back into a small parking space under a split-rail carport with corrugated-steel siding. At the next house over, across a small field, I saw a pig and a chicken lazing in the sun. The man from the front appeared and retrieved a fuel can. They barely spoke to each other, Francel and this man. They were operating within an invisible system. This transaction was, in fact, part of the vast and intricate web of improvised systems that constitutes the only way Cuba truly functions. Multiple generations of life with rationed food, little money, and a government set on isolation have produced a resourceful people. We humans are indeed a creative little animal, and we find ways to help ourselves. Where I live, we have the luxury of exercising creativity for fun. In Cuba, they have to be creative just to live.

Once the man had finished filling the tank of the Peugeot, Francel fired up the car and we drove off. I noticed the fuel gauge on his car didn't work. "How do you know when you're empty?" I asked.

He laughed.

MY

FRIENDS AND I TRAVELLED TO Cuba on a sort of curiosity vacation. We wanted to see Cuba before the country's newly normalised relations with the United States became truly normal. In America the maker movement is at its height, a wave of people building and making and creating things with technologies that improve by the day. In Cuba, they've had a maker movement since 1960, fuelled largely by necessity. I wanted to see if the instincts were the same.

We spent our first three days in Havana in a *casa particular*, a private home that rents rooms to tourists. It works much like Airbnb, but it's a system the Cuban government formalised in 1997. We had booked a room in Casa Leticia, one of the most highly rated casas in Vedado, which, according to the Internet, is the hippest neighbourhood in Havana.

A cab from the airport dropped us off in front of the casa. The houses here were built right up to the crumbling sidewalks, two or three storeys high, and wore faded paint stripped to dirty pastel shades by the salty ocean air. An old man in a red Havana Club vest sat alone on the sidewalk. Two skinny dogs lay on their sides panting. I thought there'd been a mistake. We double-checked the address. We were in the right place. Upon closer examination I saw a sticker above the door of the inauspicious building that was Casa Leticia: "2014 Winner, TripAdvisor Certificate of Excellence."

We rang the doorbell, and Leticia herself opened the gate. A large, sunny interior courtyard was paved with perfect ceramic tile, lush with greenery, and outfitted with white wrought-iron patio furniture. A peristyle surrounded the courtyard, yellow-painted columns complementing green and blue-striped awnings hung between them. Inside, the immaculate house had ornately painted 6-metre ceilings and – crucially, it would turn out – a bathroom, complete with shiny new fixtures.

Leticia, who was in her fifties, was short with blond hair and fair skin. Her eyes never stopped smiling and dimples appeared on her cheeks when she talked. She funnelled us towards the dining room, where we filled out the simple paperwork that logged our stay. Then she opened a handsomely decorated liquor cabinet in the corner of the room and produced three glasses and a bottle of Havana Club, poured us each a shot, and gave us advice for our stay or for life or both.

"You are three young men. Watch out for chicas. There is no



Pre-1959 American vehicles are a common sight on Cuban roads, and no, all the taxi cabs aren't yellow.

such thing as love at first sight.

"You will come across people who are very impressive. Well travelled. They will speak multiple languages and know places to take you. But when you get to the end of the day and you've paid for everything, they're gone.

"You are here because of the new Obama laws. Visit Cuba with an open mind."

Leticia had a system for everything.

H

AVANA IS A GREAT CRUMBLING beauty in a constant state of repair. Walking through the neighbourhood near Leticia's house, we saw some men pulling cinder blocks uphill on a wooden pallet outfitted with castors and a handle made of bent rebar. First appearances – appearances in general – are deceiving. We came to learn that the old man with the red vest was a government employee, hired to watch cars overnight. Men in red vests were stationed around the city, standing guard over the



MECÁNICA POPULAR began publication in May 1947. Above, covers from November 1963 and April 1957.

population of famed American classics and less familiar foreign makes such as Lada, made in Russia, and Geely, which is Chinese. Buildings in the city seemed to grow taller as they approached the water, where a great walkable boulevard called the Malecón traces the shore.

Like Casa Leticia, many buildings were pitiable on the outside, but astonishing on the inside. According to our guidebook, three buildings collapse per day. When their guts spill out, I'm sure they are beautiful.

Our first night we had dinner with a computer programmer named Medardo Rodríguez. I had read about an entrepreneurship club he ran and contacted him before our trip. Medardo met us at the Hotel Nacional, one of the few buildings whose outside is as immaculate as the inside. It sits on a bluff over Havana Bay, outdoor seating arranged around two incongruous bits of decor: cannons from the armoury that preceded the hotel on the site and an art installation riffing on bathrooms. A porcelain toilet stood on a tiled and

graffitied pedestal. A lifeguard tower had a commode for a chair. Creative reclamation.

Medardo was older than I'd expected for the leader of a group devoted to developing a startup culture where virtually none exists. Balding and pushing forty, he wore trendy plastic glasses and bounced while he walked. He reminded me of a grizzled Silicon Valley veteran who'd survived the dot-com bubble with his enthusiasm for technology intact.

At the restaurant Medardo explained his role in the Merchise Startup Circle, the organisation trying to engage and develop entrepreneurs in Cuba. The group grew out of a programming collective Medardo founded at the University "Marta Abreu" of Las Villas in central Cuba in the early 1990s. He taught programming as a practice of creative thinking. The group developed video games and even a Web browser, but broke up in the early 2000s. It is difficult to maintain a programming collective in a country where the number of citizens with access to the Internet hovers at around 5 per cent.

That hasn't stopped the group from reforming under a new guise. Creative thinking properly focused is entrepreneurship.

And to Medardo, being disconnected from the rest of the world has in fact been the very stimulus of his most creative thinking. He learnt from programming that being connected can be a distraction. Perhaps, he wondered, programmers learn better without the buzzing Internet constantly robbing their attentiveness. How easily might someone else's creativity replace our own, if we let it?

As we were eating and talking, life in the courtyard suddenly stopped. The space had been full of the din of other tables and friends, a vending-machine hum, the clatter of the kitchen. Suddenly, silence. The power had gone out.



A young shoe-maker repairing shoes at a street of Havana.

"Now you are knowing the real Cuba," Medardo said.

As workers retrieved portable lights, we strangers simultaneously pulled out our smartphones, turned on their flashlights, and placed them on the table. Someone said the light was too harsh. "Use the saltshaker," said a voice in the crowd. My friend put one over his phone's light. The crystals softened its glow. Each of us who could find a saltshaker did the same, and, just like that, we invented mood lighting.

A

AFTER HAVANA WE VISITED TRINIDAD, a colonial town with cobblestone streets. We stayed at Casa Balbina, where our host, Ricardo, was a retired chemistry professor. I told him I worked for an American magazine called POPULAR MECHANICS, and he laughed and explained that Cuba used to have a magazine called MECÁNICA POPULAR. Ricardo had to be in his eighties, old enough to have read MECÁNICA POPULAR, the Spanish-language edition of POPULAR MECHANICS, before the embargo started in 1960. I've heard some older Cubans still have collections of them. They might be on the shelf next to *Con Nuestros Propios Esfuerzos* ("With Our Own Efforts"), a government publication from the post-Soviet era that provided shop notes for Cubans trying to get by as their economy collapsed. In POPULAR MECHANICS, the motto for our Shop Notes section is "Easy Ways to Do Hard Things." *Con Nuestros Propios Esfuerzos* also has a motto, from Fidel Castro: "Nothing is impossible for those who fight."

In early 1960, MECÁNICA POPULAR split into two local editions: one for South America, and one for Mexico and the Caribbean. Trinidad feels like a city paused in that moment. Built on an easy



Above: Chevrolet in classic pink and white two-tone pulls out of a side street in Varadero.

Left: Coco(nut) taxis are an affordable option for locals and tourists.



slope up from the Caribbean shore, it is an anthill of workers. A man cut tile on a table saw in the dark anteroom of his home. Another tossed cinder blocks from a cart on the street to a fellow working inside. The cobblestones had been removed from a hillside street to make way for plumbing work. On another street neat stacks of stones cordoned off a repaving project, the way bright orange cones would be used in more developed locales. In Cuba, when a system doesn't exist, they make one.

Trudging uphill to make a dinner reservation, we saw a man working alone on a red brick wall. He spread mortar in thick gray slabs and placed bricks in an alternating pattern – header, stretch, header, stretch. It was hot and sweaty work on a hot and sweaty day, but he wore protective long sleeves and pants and a work belt. He reminded me of the construction workers on the tract homes in Sacramento, California, where I grew up. The summer sun routinely pushed temperatures close to 40 degrees, but practicality outweighed comfort. They wore jeans and long flannel.

We ate dinner at a paladar, a privately owned restaurant that was part of a formalised system analogous to that of the *casas particulares*. The waiters were trained by the state-owned catering company. They were dressed formally and brought out entrées on platters covered with silver lids, which they removed from everyone's dish at exactly the same time.

Over dinner we talked about what we had seen, and what we had not seen. We had been to multiple restaurants that offered only a small portion of the items on their menus. We had tried to visit museums and been foiled by idiosyncratic schedules. We had made an attempt to buy a wireless Internet card at the state telecom office during a service outage. "The most productive person we've seen was throwing bricks," one of my friends said.

Part of the fascination of seeing men perform manual labour in Cuba is that, unlike in the US, the other options are less obvious, and the work itself seemed to animate the people doing it. We had seen plenty of Cubans who had jobs in air-conditioned rooms: rental-car clerks, people who worked in stores. In the US those would be seen as better jobs than building a brick wall. On this street in Trinidad, the opposite felt true.

After dinner – chicken and lamb, with a buffet of sides like rice and beans and tropical fruits – when we were walking home, we saw the bricklayer's wall nearly finished.

I T'S FUNNY, I almost didn't get to go to Cuba at all. My two buddies went through Cuban immigration without a hitch. I didn't have any problems at first, but when my suitcase went through the scanner, it raised a red flag. I had brought seventeen copies of the June US issue of *POPULAR MECHANICS*, thinking I would meet people who might like it – people who've managed to maintain a 1950 Chevrolet for sixty-five years, or who keep buildings from turning to rubble, or who've cast livelihoods from the raw materials of everyday life. People who have learnt to improvise to the point where improvisation becomes the way to keep living. But I'd overlooked the possibility that a suitcase full of American magazines might look like propaganda, especially considering that the headline on the cover of the "Maker Nation" issue I'd brought was "How you can join the revolution."

The first customs agent asked if I spoke Spanish (no). She brought over a second agent with better English to ask me to explain myself. I tried to articulate what *POPULAR MECHANICS* is about, then I tried to make up a story about giving the magazines to my friends to take home, but the language barrier made it difficult – and, also, that made no sense. Seeing the commotion, a third agent came over and immediately started examining the magazine. Things began to turn. I continued arguing my case, but now I was watching this third agent. He flipped through the magazine, stopping on all the best pages: the beautiful things, the projects, the makers. I struggled for words. He saw something he recognised.



SOMETHING OLD, SOMETHING NEW, SOMETHING BORROWED...

Before the onset of the Cold War, Cubans could basically pick and choose to their hearts' content from an array of Ford, Chevrolets and Pontiacs. The fifties were, after all, what many describe as the golden years of American motoring. But the years that followed delivered a blow as sanctions against the Caribbean nation saw very little trickle into the country apart from Soviet-era Ladas – many of which are still in use today.

In fact, the vast majority of the pre-1960 American vehicles are still in running condition, not that Cubans have a strong desire to preserve classics, but out of sheer necessity. With the modern motor vehicle reserved for only a privileged few, from the even fewer manufacturers that sell vehicles in Cuba, those who have managed to obtain a vehicle have had to get creative

with maintenance – because spare parts are scarce and hard to obtain from abroad.

It's not uncommon to come across a '57 Bel Air Chevrolet that might look "stock" on the outside, but is really kept together with an eclectic mix of parts from other vehicles. The mix might include seats from old Volvos, a reliable Toyota turbodiesel engine or even a fuel-efficient Fiat four-cylinder, the odd item sourced from an old train or even bits from two different cars that have been bolted together. There are plenty of European cars from the '80s and '90s on Cuban streets, too, most of them Renaults and Peugeots used as taxis. Newer vehicles come from Korea or China as cars from manufacturers such as Hyundai and Geely offer plenty of value for money.

With the average Cuban earning a salary of less than R300, buying a new Mercedes-Benz C-Class is completely out of the question. Fortunately, their ingenuity and will to survive have seen Cubans make do just fine. – KYLE KOCK **PM**



WIN

Three lucky readers will each win a TW Steel watch from the Grandeur Diver collection, worth R10 500 each!

The distinctive Grandeur Diver collection by TW Steel features Chronograph movement, a threaded crown and case back for additional strength and water resistance down to 200 metres. This bold timepiece is crafted out of high-grade stainless steel with rose gold PVD plating. Its silicone strap incorporates an anti-dust protection layer. Dutch by design, big in attitude and peerless in class, this watch will certainly make a statement.

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TO ENTER, ANSWER THE FOLLOWING QUESTION:

To what depth in metres is the TW Grandeur Diver Collection water-resistant?
SMS the keyword **TW**, followed by the answer, your name and email address to 32697 (R1,50 per sms; this service does not allow for 8ta numbers). To enter online visit our website at www.popularmechanics.co.za. Competition closes 30 November 2015 and the winner will be drawn on 7 December 2015.

Competition rules:

1. Entry is open to anyone except employees (and their immediate families) of RamsayMedia. **2.** Only one online entry per person. You may enter via SMS as many times as you like (SMS charged at R1,50). **3.** Competition runs until 30 November 2015. **4.** We will draw the winner(s) on 7 December 2015. **5.** The prize is not redeemable for cash. **6.** Prizes not claimed within three months will be forfeited. **7.** The judges' decision is final and no correspondence will be entered into. **8.** Regrettably, only South African residents are eligible for prizes. **9.** By entering this competition, you agree to receive future correspondence from POPULAR MECHANICS. You can opt out at any stage by: (a) Sending an e-mail containing the relevant details with the subject line "opt out" to pmmailers@ramsaymedia.co.za; or (b) Sending an SMS including the word "STOP" to 31699. Standard SMS rates apply.

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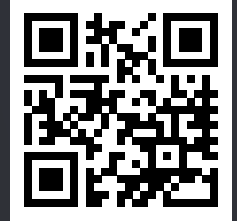
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SKILLS



HOME OWNERSHIP, OH, JOY

When you peel back the layers of a house, you see things. Terrifying things. Things that make you yearn for the apartment in the city where you could just call the landlord. Then you remember why you moved.

BY RYAN D'AGOSTINO

HOME OWNERSHIP IS THIS: Fourth of July. Outside the air is a dry 31 degrees, breeze out of the southeast, flag fluttering in its brass bracket on the front porch. My two kids are in the backyard trying to rig a zipline from the tree fort to the swing set. My wife is making iced tea and packing some boxes to store in the attic.

Me? I'm up here in said attic. I don't know how hot it is, but it feels like at least 60 degrees, and there's certainly no breeze out of the southeast or anywhere else. It's a long weekend, and I'm using the string of days to reinsulate my attic and lay down a plywood floor. I'm wearing work pants, a long-sleeved T-shirt (Grumpy's, a tavern in Ketchum, Idaho), and unbreathable Tyvek coveralls. Invisible flecks of

pink glass fibre insulation float in the hot, dense air, looking for my skin. They sting my neck and wrists. My paper ventilation mask smells like the breath of a dog that has just eaten a tuna sandwich with a side of dead mouse. Sweat flies off my face and drips into my eyes and off the brim of my cap. I think I can hear the faint laughter of my children playing outside, but it might just be the sound of glass fibre splinters scratching my brain. I see visions of them running through the grass, or maybe that's just the deranged wasp that keeps flying into my safety goggles.

So this is home ownership, I'm thinking. These moments happen to everyone, do-it-yourselfers or call-the-plumber types alike: you hate your house, you hate your-

self for buying it, you hate heat or water or the bitter cold or whatever it is that's assaulting your dwelling this time. You just want everything to work so you can sit down and watch a meaningless game on TV. And you consider, briefly, the fact that you are but a speck of dust in the universe fixing a problem that doesn't matter to mankind but that nonetheless must be fixed.

Today's problem began a couple of months ago, when senior editor Roy Berendsohn and I, with help from contributing editor Richard Romanski, installed a set of springloaded, pull-down stairs in my attic, the kind that disappear into the ceiling. We figured it would take the better part of a day. But when you start peeling back the

layers of a house – any house, but especially one built in 1854 – you find that nothing is going to take the amount of time you thought it would. You can generally take your initial estimate and multiply it by 3,5. Then add a couple of hours.

We planned to install the attic stairs over my home's main staircase. I wanted the bottom step of the extended fold-down stairs to rest neatly on the landing at the top of the main stairs, but the location of an antique light fixture foiled my plan. The attic stairs, once unfolded, would in fact be dangling in midair, suspended. Obviously not an option. Nevertheless, we stared at the scene for a good hour, looking for some other way. This is one of the hallmarks of home remodelling: when an unforeseen obstacle renders your plan undoable, your brain doesn't know how to accept it at first, because you had one vision in your mind, so you spend 45 minutes to an hour just staring.

Roy said something like, "I don't suppose you'd want to put it in the bedroom?"

Roy. Always thinking outside the vestibule. Of course! My son's bedroom had plenty of room to install and then pull down the stairs. So we walked into his room and stared at the ceiling for about an hour, trying to get used to the new plan, thinking it through. Every once in a while we'd measure something. Maybe make a pencil mark on the ceiling. That's another remodelling routine: stare, measure, mark, stare. Discuss.

Then it was lunchtime.

After the meatball sandwiches, we moved all the furniture out of the room.

In the attic we found horrors: ceiling joists with bark still on them. Homemade lumber, sometimes nailed to nothing. Scraps hammered together at bizarre angles, no two boards alike. How was the house even standing?

We hung sheets of plastic everywhere. We laid cardboard on the floor. We had one guy in the attic – at this point accessible only through a ceiling hole in another room that you reached by climbing a step-ladder and hoisting yourself up through, like a gymnast mounting a balance beam – and one guy in the room. I christened the Milwaukee Sawzall my brother gave me for Christmas, cutting a perfect rectangle in the ceiling according to the stair manufacturer's specifications. And when we went up through the hole into the attic and examined the situation, this is what we discovered: My house was probably built by drunken elves using twigs and branches they found in the woods, which they cut to length by chewing them.

It was unbelievable. Ceiling joists with the tree bark still on them. Ceiling joists that weren't long enough to reach from roof rafter to roof rafter, so they were sistered to another piece of wood to complete the journey – which, of course, led to wildly erratic spacing between the joists. In the corners and other oddly shaped spots, the builders had nailed together scraps of wood at bizarre angles. Sometimes the homemade lumber was nailed to nothing at all. The joists them-

selves were mere 50 x 100 planks, not the requisite 200-millimetre, or at least 150-millimetre ones, you'd use today. And they were of unequal dimension, no two alike.

And yet: there we were. Standing in a house that itself had been standing for 160 years, through blizzards and hurricanes, through multiple generations of multiple families, through the introduction of electricity and plumbing, through ice and heat and heavy rain. Somehow, here it was.

When my home was built, many balloon-framed houses were constructed using whatever wood was available within walking distance, and the beams in mine, uneven though they were, had been milled from solid, dense hemlock. The nails were cut steel. The more closely we looked at the house's construction – and we looked at it very closely, because you can't even stand up in the attic, so our noses were practically pressed against the floor and walls and underside of the roof – the more we realised that whoever built this house may not have had the finest materials available, but he was remarkably resourceful at assembling what he had.

Because we had sawed through two of

THE DEMOLITION TOOLBOX

The basic arsenal of equipment you need to smash part of your home into oblivion.



Ripping bar

To remodel you need a ripping bar. It's got a cat's paw at one end for digging out nails, and a V-notch chisel and nail slot at the other. You can do everything with it from lifting shingles to dismantling wall framing.



Sawzall

There will be a lot to cut: nail-studded framing lumber and cast-iron pipe, shingles, tree branches, even roots. Only one tool handles all that, the mighty reciprocating saw. Our vote is for the famous Milwaukee Super Sawzall.



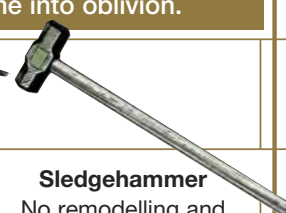
Framing hammer

The solid-steel framing hammer is nearly unbreakable. When you're madly tearing out lumber in a confined space or driving a nail somewhere you're sure to hit the handle, you'll be glad you have this puppy.



Oscillating multitool

Although demolition and remodelling can be a savage business, there are times when precision is called for. Enter the oscillating multitool. It cuts in impossible places, making clean slices through wood, metal, and plaster.



Sledgehammer

No remodelling and demolition kit is complete without a high-quality sledge. Don't waste money on a cheap one that will chip when it strikes concrete. Buy one that's drop-forged and heat-treated. Swing with impunity.

the joists holding up the ceiling in my son's room, we had to reframe the hole, adding crossmembers to make up for the lost strength. For this we used fresh 50 x 100s doubled up to the existing joists, perpendicular ones at either end of the hole, and 150-millimetre beams laid flat and screwed into the joists to pull them together. Then we hoisted the stair unit into place – backwards, of course, the first time, which necessitated pulling it down and flipping it around. We fastened it to our new framing with construction screws. Then we patched the ragged edges of the hole with joint compound and added trim to cover the seam. My sons sat in the corner of the room, giving periodic thumbs-ups. All of this took until after dinner on day two of the project, but we did it.

Two months later, when I finally had that three-day stretch provided by the Fourth of July weekend, I drove over to Ridgefield Supply, my excellent local hardware store/lumberyard/everything centre, to talk to Tom Cicero, one of the store's all-knowing salesmen. Tom is a dry guy, and I could tell he thought I was insane for insulating my attic over the hot holiday weekend. He was also concerned about the fact that any flooring I put down over the insulation would crush some of the fibres, compromising its effectiveness. Tom and I finally came up with a plan that would minimise fibre smashing while maximising the R-value of my attic insulation from whatever it was to at least nineteen, respectable for my part of the country.

I was glad I hadn't dragged Roy into this, because I'd felt bad enough that our attic-stairs project had turned into such a bear. Now, though, I wished he could see it. The attic was starting to look like something. Fresh, pink clouds of insulation in tidy rows, and a network of plywood creating a sturdy floor for storage. I was proud, but I was also drenched and felt like I'd been clocked in the knees and worked over with wet sandpaper.

A half-hour shower later, I walked outside. The temperature was pushing 32, but it felt cool and crisp after hours in the hot attic. I joined my boys for some backyard soccer and an intense game of monkey in the middle. Inside, my wife was marinating some steaks for dinner. I lit the Weber, poured myself a drink, and sat on the picnic table admiring some bugs my six-year-old son had collected and put in his pocket. And I thought, this is what home ownership is.

THE PHYSICS OF INSULATION

Glass fibre insulation is simple to install, but it's not foolproof. Understanding how it works will help you avoid the very avoidable mistakes that could render all of your hot, sweaty, miserable work useless.

Installing glass fibre insulation in an attic may be a basic job, but the material itself is surprisingly sophisticated. "With glass fibre, you can control all its properties – thermal, chemical and mechanical," says Marcus V A Bianchi, senior building science programme lead for Owens Corning. When glass fibres are woven into a roll or batt, they trap millions of tiny, irregularly shaped air pockets. Air, being a gas, is a poor conductor of heat energy. These pockets work together to block the three forms of energy movement: conduction energy moving through a solid, convection energy moving through a gas or liquid and radiation energy movement in the form of a wave or particle, like light.

"If people have any hope of realising the full potential of the insulation, they need to understand the basics," says Bruce Harley, an engineer at a firm specialising in energy efficiency. **The first step, he says, is sealing.** Insulation is porous, and air moving through it lessens the R-value, or resistance to heat flow. Use spray foam around wires and pipes and aluminium flashing. Use 100 per cent silicone caulk to seal gaps around chimneys. Rigid foam board can cover holes at plumbing and duct chases or soffits over kitchen cabinets, and duct mastic seals leaky air-conditioning ducts.

When everything is sealed and you've insulated the bays between each joist, **a second, perpendicular layer catches stray leaks** [Fig. 1] and increases the R-value. Just be sure to **avoid crushing insulation with flooring**



Fig. 1

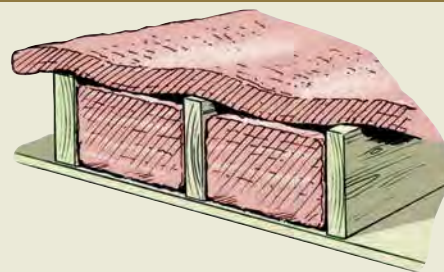
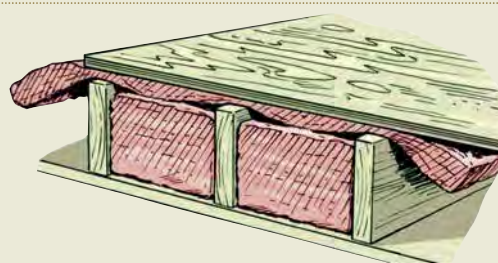


Fig. 2



[Fig. 2]. If those tiny air pockets are compressed, hot air can pass freely through that part of the material, rendering the rest of it useless.

And if you don't have enough insulation to cover the last couple of square metres? Buy more. "Small gaps have a disproportionately

large effect on R-value," Harley says. **The thickness of the surrounding insulation won't make up for a gap.** "Think of the hull of a boat," he says. "It's great to have a thick hull. But if there's a hole in it, it's the hole that matters." – ROY BERENDSOHN

Keep it out of your nose

Few jobs are less fun than insulating. Don't make it worse by hurting yourself – or your house.

DO

Use kneeling boards to support yourself. Avoid perching on joists. Wear a dust mask, protective eye-wear, kneepads, and overalls or a long-sleeved shirt. Beware of nails protruding from above and below.

DON'T

Cover recessed light fixtures with insulation that is not rated for insulation contact. Damage fragile cloth-covered wiring. Block eave soffit vents. Use insulation as an exfoliant. **PM**

SKILLS | ASK ROY

POPULAR MECHANICS' senior home editor solves your most pressing problems.

BY ROY BERENDSOHN



Q My inexpensive score-and-snap tile cutter doesn't always make a clean cut. Sometimes the cut edge is a little rough, which shows after the tile is grouted. Any advice?

A Cut-and-snap tools (like the one pictured) work best on smooth, vitreous (porcelain-coated) wall and floor tiles. For non-vitreous and textured tiles, however, you're better off using a wet saw.

Assuming you are cutting vitreous tiles, you should do the following: hold the tile firmly against the tool's base and make one firm score line, not multiple passes. If the tile slips while scoring or while snapping it, you'll get a ragged break. Use a carbide-grit tile file – which, if you don't own, you should – to clean up minor imperfections on a cut edge. In a pinch you can even rub the cut edge of a scrap piece of tile against the cut edge you just made. Wear gloves while you're doing this, because the tile's cut edge is very sharp. Other causes of bad breaks are a dull cutting wheel and a film of dust or grit on the tile surface that prevents the cutting wheel from scoring a clean line.

If you have a lot of tile work to do, treat yourself to a professional-duty model.

Q I scrubbed off the oil stains on my asphalt driveway with dish soap, but they came back. Is there any way to permanently remove them?

A You need a more chemically aggressive concentrated cleaner. Use a stiff brush to scrub in Quikrete Concrete and Asphalt Cleaner or Oil Eater Cleaner and Degreaser. Maybe just as important: follow the cleaning with an acrylic sealer that prevents bleed-through and then seal the driveway.

Q The concrete sidewalks at the front, rear and sides of our house all appear to have moved away from the foundation, leaving a gap with the house. What happened?

A That gap occurs when the asphalt-impregnated isolation strip that separates the concrete from the house deteriorates (this normally takes ten to 15 years). Fill the gap by installing a small foam backer rod (it looks like a dowel made out of plastic cellular foam) and applying a bead of polyurethane self-levelling sealant over it. To ensure that this is a long-lasting repair, the layer of sealant should be twice as wide as it is deep. In most cases the gap is about 10 millimetres wide, so place the foam backer just a bit more than 5 millimetres below the

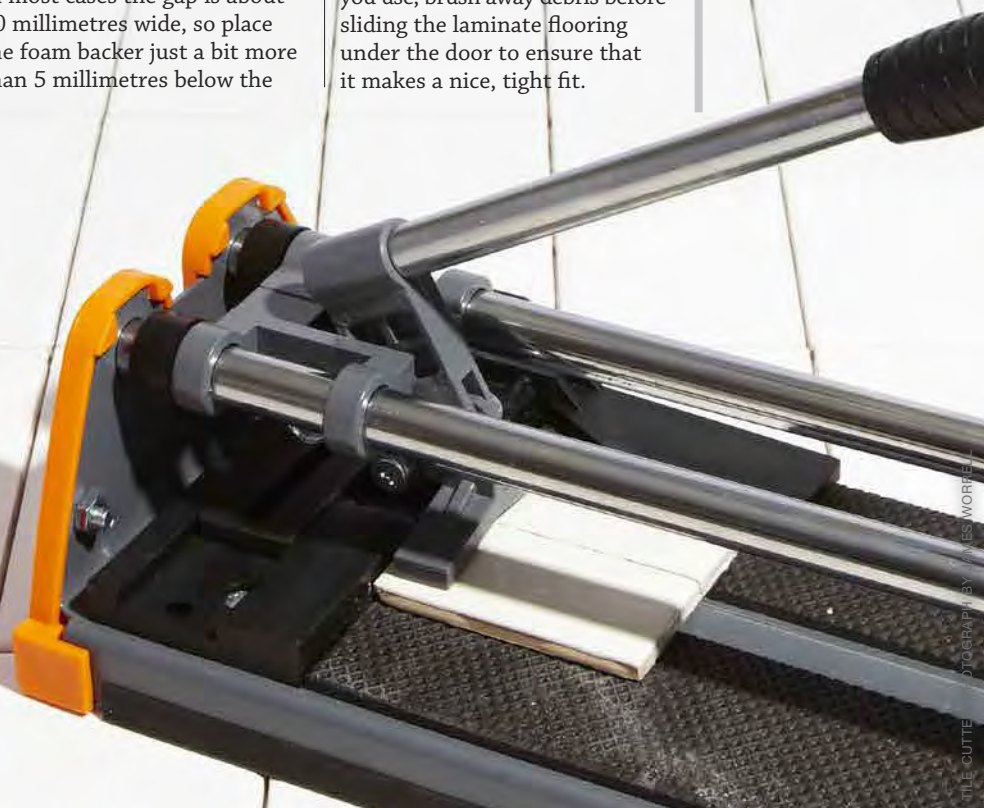
surface of the concrete, and apply the sealant so that it's almost even with the top of the concrete.

Q I'm having a terrible time undercutting my doorjamb to install laminate floor. How can I get a cleaner cut?

A Contractors make short work of this job with an oscillating multitool. To use one, first hold a piece of flooring supported on its underlayment against the doorjamb and trim. Rest the tool's blade level with the piece, turn the saw on, and bring the blade in contact with the wood. Don't force the saw through the cut. Just let it work. As you manoeuvre around the opening, the tool's oscillating motion quickly and cleanly severs the jamb and door trim. Alternatively, an undercut saw is much less expensive. It's more work, but the same rule applies. Use light pressure, and let the saw's teeth do the cutting. Whatever method you use, brush away debris before sliding the laminate flooring under the door to ensure that it makes a nice, tight fit.



Roy knows, but do you? If you think you do – or even if you just have a creative guess that people of good taste might find amusing – email it to popularmechanics@ramsaymedia.co.za. One hint: It has nothing to do with orthodontia.



PROJECT

BUILD YOUR OWN STAND-UP DESK

Sitting down is not good for you. It's time to give in. It's time to stand up.

DESIGNED BY RICHARD ROMANSKI

→ For proper ergonomics, build your desk at a height that places your sight line within the top few centimetres of your screen.



THE SWITCH BY ALEXANDER GEORGE

One Sunday, under cover of darkness, I came to the POPULAR MECHANICS offices to set up my standing desk. I put my monitor and keyboard on the plug and play products that, after weeks in hiding, I'd finally assembled the Friday before with the help of our senior home editor, Roy Berendsohn. I was ready to broadcast my commitment.

Before I set it up, the idea of using a stand-up desk felt pretentious – a conspicuous expression of self-improvement, the ergonomic equivalent of watching your friends order fries and shakes, then asking the waiter if you can get a chicken burger without the bun. But the desk was loved, and not just by me. People smiled while saying that they'd heard about the benefits and wanted one for themselves. Roy told me about a time he stood during

most of a long-distance flight to alleviate his back pain, and that this setup looked like it could provide the same benefit. Hell, our deputy editor even ended up getting the exercise ball he said he'd been wanting to use as a chair. (He lasted only two days, though.)

Six months in, I'm still not fully acclimatised, but the benefits are clear. I thought it was psychosomatic, but I've since heard from other converts that standing properly (ears in line with your shoulders, a physical therapist friend told me) actually helps you focus. I no longer dart between Twitter and the article I'm editing. Standing, somehow, eliminated that. My posture is better, and the slight ache I sometimes feel in my feet is worth it. I do take occasional breaks, but their duration decreases every day. As does my nostalgia for sitting down.

PROJECT

THE DESK

BY RICHARD ROMANSKI

This stand is proportioned to fit atop a 70-centimetre-tall desk. If your desk is a different size, you can simply adjust the position of the stand's cross supports and shorten or lengthen its A-frame uprights. When the stand is not in use, just slide out the shelves, fold the uprights together, and tuck everything away.

MAKE THE PIECES

► Begin by crosscutting the poplar uprights and hinge blocks to rough length. Rip them to 65 millimetres wide, and plane to the finished thickness.

► With a mitre saw, crosscut all pieces to the finished dimension. (Use a stopblock on the saw to ensure that the pieces are cut to consistent lengths.)

► The dowels that form the cross supports for each pair of uprights are seated in shallow half-round grooves. To make these grooves, use masking tape to hold the front uprights together. Do the same for the rear uprights. For each pair, use a square to align the pieces **1**, and mark the centrelines for the holes according to the drawing at right.

► Set up a fence on a drill press with an installed brad-point drill bit. Take two pieces of scrap poplar, clamp them together, and mark straight across them to indicate a centreline. Use those pieces to position the drill-press fence so that the bit comes down centred between the test pieces. When the fence is securely positioned and clamped to the wood, make a test bore. Mark the bit's centreline on the drill-press fence.

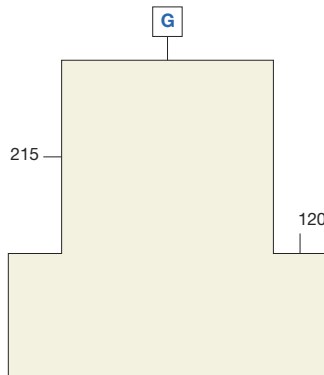
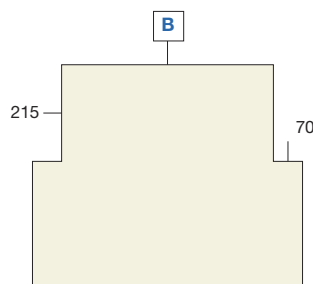
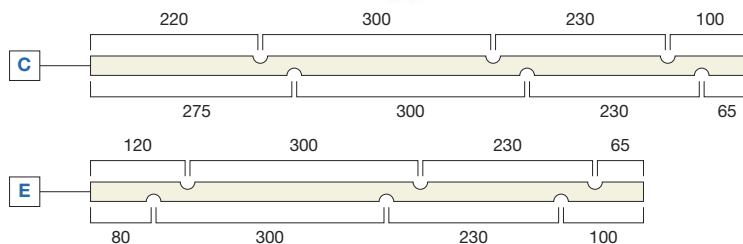
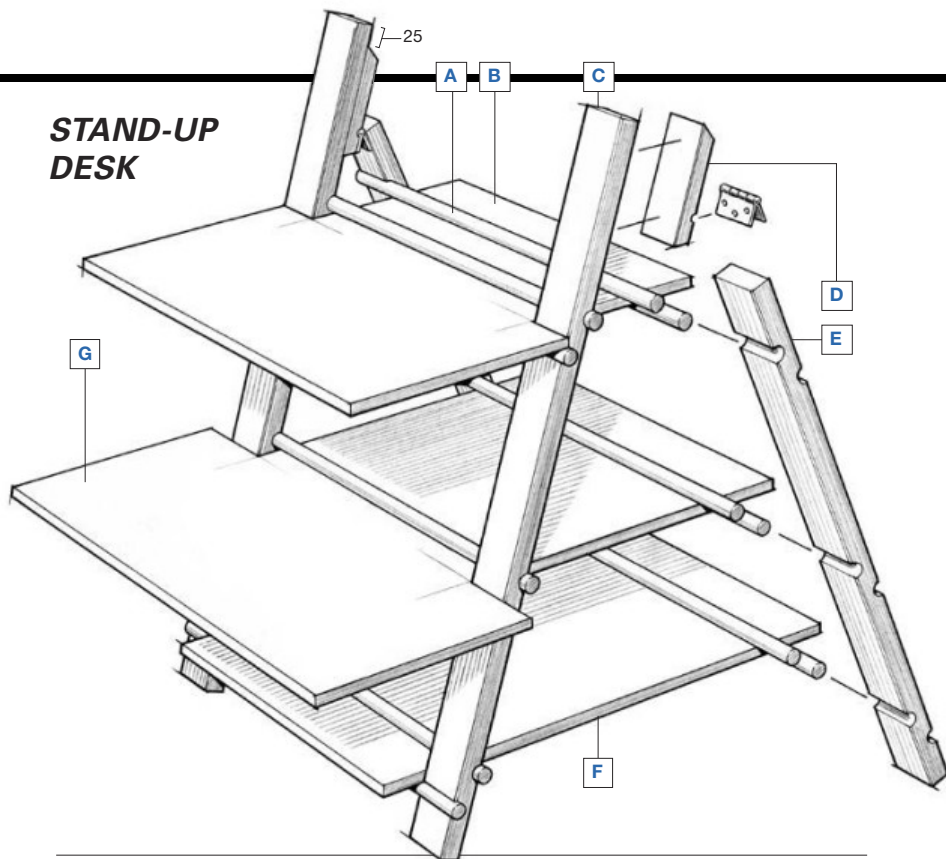
► Take the paired front uprights and align the first centerline you previously marked on them with the line you just made on the drill-press fence. Clamp the uprights to the fence and bore the first hole. Move the uprights down and reclamp them by the second hole, and so on. Repeat the process for the rear uprights.

► After you've bored three holes in each pair of uprights, separate them, retape them with the back of the sides in the centre, and repeat the hole-boring procedure above **2**. Repeat it one more time to produce the half-round hole in the hinge blocks.

► Next, plane or saw away any tearouts caused by the brad point exiting the edge of the uprights.

► Cut the dowels to length on the mitre saw. ► Rip and crosscut the MDF panels using a circular saw. For the top and centre panels, cut each notch on the table saw **3**. Finish these notches with a sabre saw.

STAND-UP DESK



Materials

KEY QTY SIZE AND DESCRIPTION

A	12	20 dia. x 600 cross supports
B	1	12 x 500 x 600 top panel
C	2	25 x 65 x 865 front uprights
D	2	25 x 65 x 135 hinge blocks
E	2	25 x 65 x 720 rear uprights
F	1	12 x 475 x 635 bottom panel
G	1	12 x 700 x 700 centre panel

Supplies

QTY SIZE AND DESCRIPTION

1	25 x 130 x 1,8 m poplar
1	12 x 1,2 m x 2,5 m ultralight MDF
6	20 x 1,2 m dowel rods
1	pkg. (2 pcs) 65 x 65 Hillman No. 852844 stainless-steel door hinges
1	pkg. (56 pcs) No. 6 x 30 Hillman 823628 stainless-steel oval-head Phillips screws
1	pkg. (18 pcs) bumper pads

ILLUSTRATION BY GEORGE RETSECK



1 Tape the uprights together, use a square to align them, and mark each hole location.



2 Clamp the uprights to the drill-press fence before boring the centre holes.



3 Instead of a circular saw, cut the notches in the MDF panels on a table saw.



4 Make a pilot jig from a scrap block to use before further securing the dowels.



5 The dowels are glued, but you'll also want to fasten each with four screws.

► Sand the uprights and the hinge blocks with 120-grit sandpaper, followed by 180- and 220-grit. Lightly sand the dowels with 220-grit sandpaper.

► Stain both sets of uprights and hinge blocks, and apply two coats of clear satin polyurethane to them. Apply one coat of finish to the dowel rods and two coats to the MDF panels.

ASSEMBLY

It doesn't matter whether you begin the assembly process on the front or the back of the uprights. The most important thing is to ensure that each dowel is square to the upright and that each upright is parallel to the one opposite it. You can accomplish this any number of ways. You can use a framing square to check the position of the dowel relative to the upright, or you can build yourself an assembly jig out of plywood and a couple scrap pieces of wood.

Fasten each dowel to an upright with a small glob of carpenter's glue. When the glue has cured, bore two pilot holes through the dowel. I used a small block of wood with a half-round groove and a pair of predrilled holes to help guide the drill bit.

4. Affix the dowels to the up-rights by driving a pair of oval-head screws at each connection

5. When three dowels have been glued and screwed on each of these uprights, glue and screw the dowels on the opposite side.

Fasten the hinge block to the front uprights with four No. 6 25 millimetre wood screws. Use the screws that come with the hinge to fasten the front leaf of each hinge to its hinge block. Swing the back uprights open and fasten the rear hinge leaf to the rear upright. Attach the self-adhesive rubber feet (bumper pads) to the uprights.

Slide the panels into the uprights and lock them in position by spreading the uprights apart until you feel a slight pinching action on the wood.

WIN! with our home workshop challenge

AND ANNOUNCING:

Workshop Challenge No. 4

Accept the **PM Home Workshop Challenge** and a **Makita DHP458ZK Cordless 18V Lithium-Ion Impact Drill Kit**, valued at **R6 386**, could be yours.

THE THEME: IN THE GARDEN

Summertime and the living is easy. And a lot of the time it's outdoors. Whether your garden is the green leafy kind or the austere Oriental kind, there's bound to be a way it can be enhanced with your own efforts. We're thinking daybed, brick braai, water feature, treetop deck, unusual planter, labour-saving device... with just one condition. Unlike Challenge No. 3, this time around you are required to creatively use at least one power tool in putting together your project. Your scope is as wide as the imagination allows.

THE PRIZE:



Makita DHP458ZK Cordless 18 V Lithium-Ion Impact Driver Drill Kit.

This top-of-the-range Makita 13 mm impact driver drill features a battery indicator that displays the remaining battery charge; twin LED lights that illuminate when the trigger is pressed; and three functions – drilling, hammer action and screw driving. The **DHP458ZK** provides plenty of power for demanding tasks, with 21 torque settings to choose from – giving you perfect control and a maximum torque of up to 91 N.m.

This model is extremely compact, with a two-speed metal gearbox and steel keyless chuck. It features a rubberised grip, an extended side handle for greater control, a reversible belt clip for both left- and right-handed operation and a twin bit holder.

Included in the prize are a **Makita DHP458ZK impact driver drill** (supplied in a handy carry case) with **2 x 4,0 Ah Makita Lithium Ion batteries** (BL1840, which recharges in 36 minutes) and a **Makita compact fast charger** (DC18RC).

To find out more, visit www.makita.co.za, like Makita on Facebook **Makita-PowerToolsSA** or call 011 878 2600.

Your project will appear in a future issue of **POPULAR MECHANICS**.

Email your plans and a picture of the results, by 13 January 2016, to popularmechanics@ramsaymedia.co.za.

For full competition rules, see www.popularmechanics.co.za/workshopchallenge

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SHOP NOTES

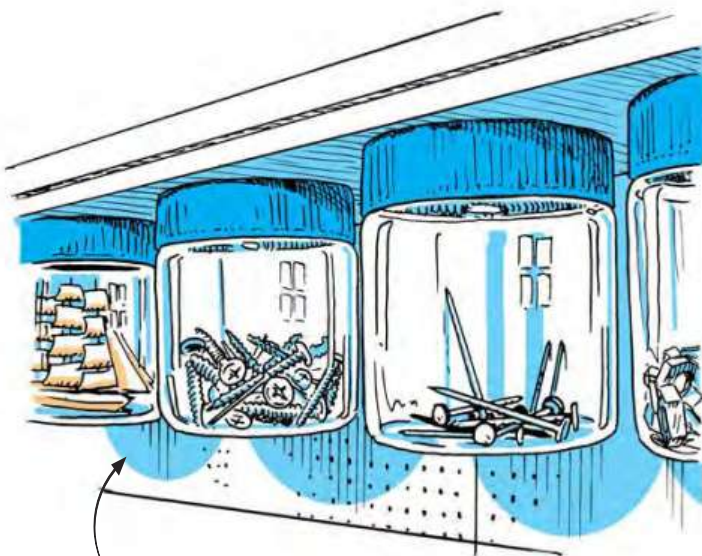


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Easy ways to do hard things



MAKE THE MOST OF STORAGE SPACES

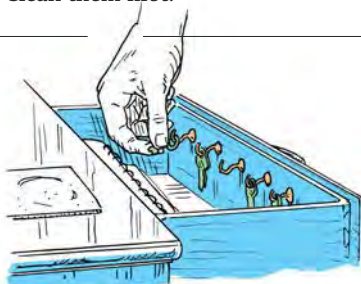


Jars allow both sides of shelf to be used

Glass jars are handy for storing fittings, fasteners and more. Attaching them to the underside of a shelf keeps them out of the way. Simply drill two holes in a jar lid and screw it into the underside of a shelf. Screw the jar into the lid for storage. Baby food, jam, and mayonnaise jars are good sizes to consider. Clean them first.

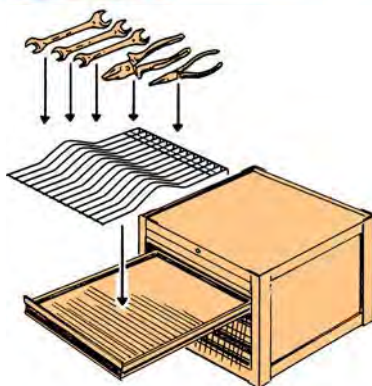
Cup hooks organise keys in drawer

Everyone has a clattering drawer full of keys that can't be thrown away but are rarely used. Cup hooks inserted on the inside of the drawer front hang keys neatly and free up space.



Wire shelf becomes tool organiser

The YouTube channel Bushcraft-arizona found a modified wire shelf to be useful for segregating different types of spanners while saving space. First, cut the shelf to fit into a toolbox drawer. Then fix it in a clamp and introduce a bend so that it rises up off the bottom of the drawer. Store spanners on their sides between the wires.



* PRACTICAL USES FOR MAGNETS AROUND THE WORKSHOP

DETERMINE THE TYPE OF METAL UNDER A LAYER OF PAINT

It's necessary to use cutting fluid when drilling steel but optional when drilling aluminium. Under paint, how can you determine which is which? A magnet clings to steel, but not to aluminium.

HOLD SMALL FASTENERS ALL THE WAY TO THE HARDWARE STORE

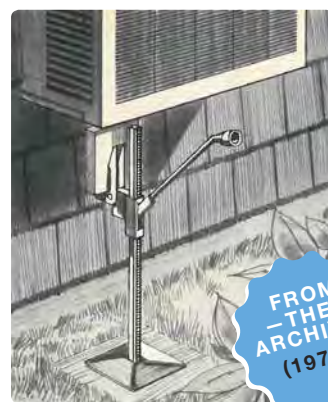
Taking a fastener to the hardware store can make for a perilous journey: small screws are easy to lose. A small button magnet in one's breast pocket corrals them.

KEEP CANISTERS FROM FALLING OFF VIBRATING WORK SURFACES

The vibration of a motor can cause an oilcan or other light canister to fall off a surface while unattended. Provided that the surface is metal, affixing a magnet to the canister with a rubber band or string will keep it in place.

MAKE A BUCKET SLOSH-PROOF

To eliminate any chance of dripping when carrying sensitive liquids in a bucket, line the bucket with a garbage bag. Fill the bucket with the liquid, then tie off the bag, sealing the contents inside.



FROM THE ARCHIVES (1972!)

Jack overcomes rust

When removing an air-conditioning unit rusted to its steel supports, break the rust seal by lifting each outside corner with a car jack.

A length of sturdy timber facilitates the lift.



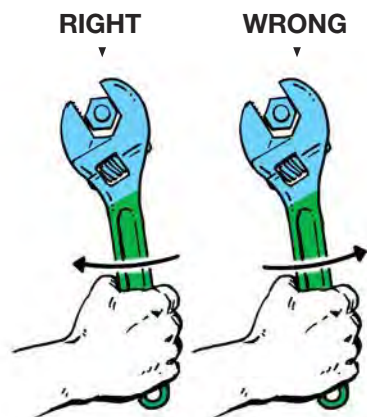
A hack for broken chains

When your chain suffers a broken link, this temporary fix avoids an immediate trip to the hardware store. Remove the broken link so that two disconnected but intact links remain. Select a nut and bolt whose shank fits through the chain links, but whose head does not. Use it to join the two good links, reuniting the broken chain.



REPORT-COVER GRIP SAFELY STORES HACKSAW BLADES

The U-shaped slide grips used to bind paper reports slip easily over hacksaw blades. So covered, blades can be stored without risk of dulling.



• SHOP SAFETY NOTE •

Use a shifting spanner pain-free

A shifter is an amazingly versatile tool – except for its propensity to slip off a nut, which can lead to injury. This is usually due to operator error. Two tips keep hands safe and nuts tight. First, pull it, don't push it. Second, make sure the fixed jaw is applying the force – the adjustable jaw can come loose under pressure. In sum, this means putting the fixed jaw on the far side of the nut from your body, and pulling the spanner handle in the clockwise direction.

FOOD COLOURING REVEALS TOILET TROUBLE

Condensation can easily be mistaken for a leaky toilet, and vice versa. Add food colouring to the tank and see if it ends up on the floor. If it does, call a plumber.






Revivify down bedclothes

Over time, down blankets, sleeping bags, and comforters lose effectiveness as the air pockets in their insulation collapse. A spin in the dryer with a few tennis balls pulverises matted clumps of down, reopening air pockets and restoring usefulness.

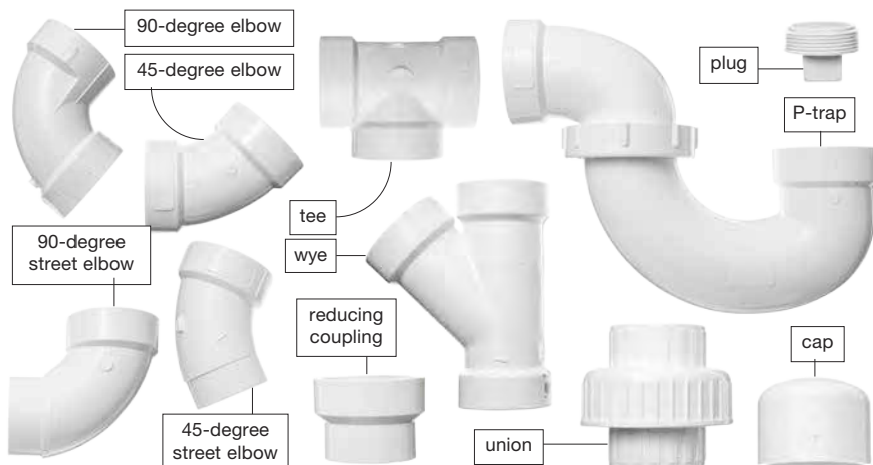
A PRIMER ON PLUMBING

Plumbing is invisible until it fails. Upon inspection, it's a morass of different pipes and arachnoid fittings. Use this handy guide to avoid confusion and prevent grisly plumbing disasters.

MATERIALS

					
	GALVANISED STEEL	COPPER	POLYVINYL CHLORIDE (PVC)	CROSS-LINKED POLYETHYLENE (PEX)	POLY-PROPYLENE (PP)
ADVANTAGES	Inexpensive, durable	Lightweight, corrosion-resistant	Inexpensive, lightweight, easy to use	Flexible, easy to join, lower propensity to leak	Durable, minimal risk of chemical exposure
DISADVANTAGES	Develops lime deposits in alkaline water	Expensive, may require brazing tools, may get stolen	Limited to uses that stay below 60 degrees, like drainage and wastewater	Damaged by UV light	Expensive, requires special tools
JOINING	Pipe is threaded, and joints are sealed with pipe-joint compound or tape.	Copper pipe is traditionally brazed, but compression fittings create brazeless joints, though they sometimes require special tools.	Cut pipe to length with a saw, then join to fittings with adhesive. Also accepts compression fittings, like copper.	After a fitting has been inserted into the pipe, a special crimping tool clamps a ring around it, forming a seal.	A heating tool is used to semi-liquefy the ends of the pipe to be joined. They are then hand-pressed together.

FITTINGS





OUR BUILDER,
Amanda Bonavita, a
12-year-old from
Staten Island, New
York, is a participant
in the FIRST Robotics
Competition. The
nationwide tournament
encourages kids to
pursue careers in
engineering and
technology.



PROJECT NOTES

TIME CAPSULE!

A project to build
with your children.

DESIGNED BY
TED KILCOMMONS

DIFFICULTY: EASY REASONABLE HARD

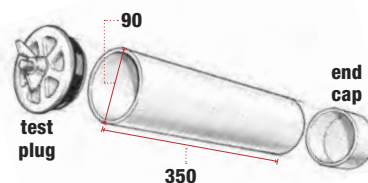
TIME: 30 minutes

AGE: 6+

THE DECISION TO USE PVC pipe for our capsule was obvious. It's tough and moisture-resistant. The only problem was how to seal it. PVC is meant to be glued together, but that would make it difficult for the person finding the capsule to get at its contents. Cutting the capsule open would mean cutting whatever was hidden inside. We discussed various schemes for building a hatch – and even a portal made of clear acrylic sheet – but they were all bulky, hard to build, or expensive.

Then we found our solution. The test plug we sealed the capsule with is designed

to be used by plumbers to pressurise and test a system. When you tighten its large wing nut, you force the rubber ring against the wall of the pipe, making an airtight seal. Perfect for a time capsule.



PHOTOGRAPH BY FRANNY AND ALBERT

GIVE

Start a child you know on a lifetime of projects with a gift subscription to **POPULAR MECHANICS**. Go to popularmechanics.co.za/subscribe/

Materials

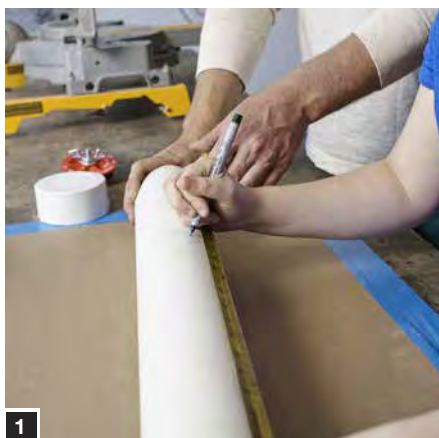
QTY DESCRIPTION

1	90 mm diameter PVC pipe
1	90 mm PVC end cap
1	90 mm PVC test plug
1	Container each PVC primer and cement
1	Can spray paint

Instructions

● parent only
● parent and kid
● kid only

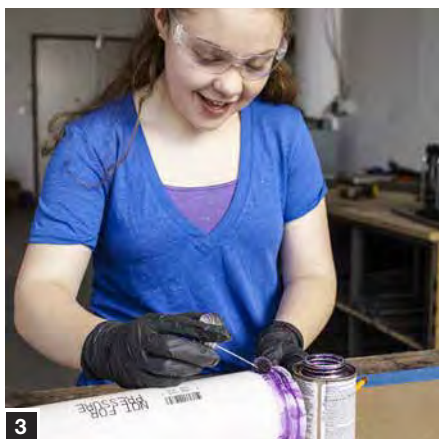
1. Measure and mark off with a Sharpie the length of the pipe necessary to hold your contents. We chose 350 mm.
2. If the child is at least 12 years old and has some experience, with careful adult supervision she can use a mitre saw to crosscut the pipe. If not, a standard eight-point carpentry handsaw is a safe alternative.
3. Apply PVC primer to the end of the pipe and on the inside of the end cap. (Be sure to open the windows for ventilation.)
4. Using the applicator tool, spread a thick layer of PVC cement onto the end of the pipe, and a thin layer on the inside of the end cap.
5. With the PVC pipe upright, tap the end cap on with a dead-blow hammer or mallet. Twist the end cap slightly to evenly distribute the cement, then finish tapping the cap until it is firmly seated.
6. Fill the time capsule with whatever you like, preferably non-perishable. Be sure to include something that indicates the date of the contents.
7. Insert the test plug into the pipe and wind the wing nut until it is firmly tightened.
8. Spray-paint the capsule.



1



2



3



4



5



6



7



8



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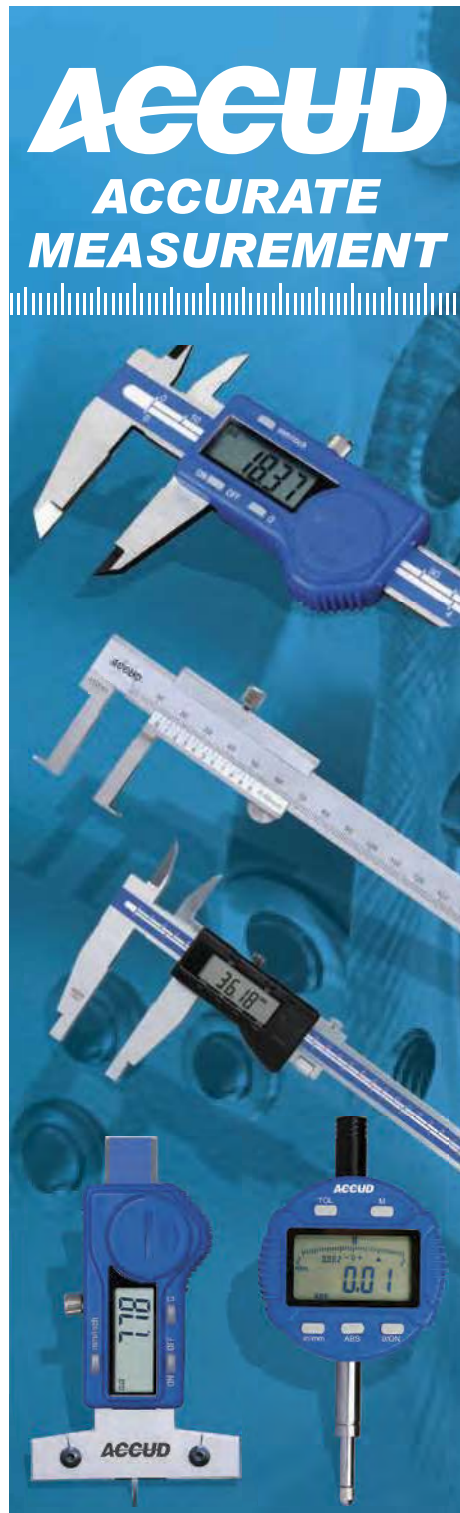
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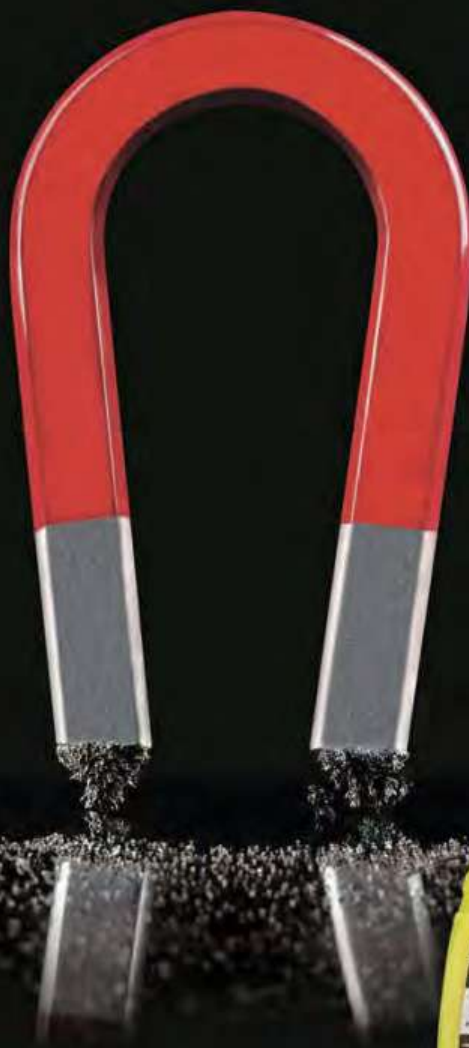
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WINNING TIP



SAVE YOUR FINGERS

After getting a wake-up call that involved some minor... er... trimming of my fingers (left), I needed a way to brace wood against my circular saw guide without using my hand. A thickish hacksaw blade in my toolbox got me thinking.

I cut a piece of wood to fit tightly in the crosscut slot on the saw table. Using a thin hacksaw blade, I then cut a slot in the piece of wood. I knocked the stiff blade into the slot, so that it would press against the guide.

Now, I can enter my wood and just push it through the blade with the push handle. For thicker pieces, I turn the wood with the blade around, so that the shorter end points towards the guide. The length of either end can easily be adjusted by moving the hacksaw blade. Any other spring steel blade can be used.

JAMES R HATTINGH
BLOUBERGRANT

STICKY - BUT ONLY WHEN NEEDED

Because I only infrequently need to use a tube of contact glue, I found that I battled to remove the cap and usually destroyed the tube in the process. Occasionally I punctured the tube. Now, after the first use and every re-use, I rub some Vaseline or grease on the cap threads before closing and Hey Presto! No more stuck caps. Draping a piece of cling wrap over the point of the tube and screwing on the cap over it worked as well. Remember to wipe the point clean before replacing the cap.

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KEEP IT TOGETHER

A common situation that one faces when working with metal is clamping items for the purpose of taking measurements and making cuts. Even worse is drilling through two flat bars while keeping them secured together. To save tons of time and money, use short Tek screws. They will cut a hole through the items to be secured to each other, quickly and easily, and give you a

firm join to mark out measurements, etc. They are just as easily unscrewed and replaced with bigger bolts. This will save time – as well as the frustration of broken drill bits and clamps working loose. Buy a pack and keep it handy.

DEANO KANNIGAN
DURBAN

DRY CLEAN YOUR SHOWER (AND BATH)

Before you lash out on expensive and abrasive cleaning fluids, try this tip. Use a hard plastic paint scraper or spatula to remove the nasty build-up on glass shower doors. This build-up is soap deposited when the condensation dries out. Acid-based cleaners can work if left long enough to neutralise the alkaline soap, but are a bit nasty on the nose.

After using the scraper, wipe off the residue with a dry cloth. This also works well with the ring left in the bath, without taking the surface off the resin surface. Wait until the surface is dry for best effect.

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